The Railway Review

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Fluid Friction.—The vexed question in the theory of fluid friction, whether finite slipping does or does not take place at the surface of a solid in contact with a liquid, forms the subject of a contribution, by Dr. Antonio Umani in a recent number of the Nuovo Cimento. The experiments, says Nature, were conducted in the physical laboratory of the university of Parma, the apparatus used consisting of a cylindrical box filled with mercury, and suspended by a torsion fibre. In one series of experiments the sides of the box were nickel plated, so that the mercury did not actually wet the metal; in another series, the mercury was made to bathe the sides of the box by thoroughly amalgamating the latter. In the former case, the presence of a film of air between the mercury and nickel was obviated by filling the box in vacuo. The observed values for the logarithmic decrement of the amplitude of the oscillations were found to differ in the two series of experiments by an amount which, Dr. Umani considers, indicates finite slipping between the mercury and the box when the latter is nickel plated. The author further proceeds to calculate the internal coefficient of viscosity of mercury from the results of his second series of experiments, and obtains the value $n = 0.01577$ C. G. S. units at temperature 10 deg. C. Warburg, employing Poiseuille's method, had previously obtained at temperature 17.2 deg. C. the value 0.01602.—[The Electrician.

The Cracking of Rubber Goods.—The cracking of rubber goods is explained by Frank W. Birchall, a recent writer, as an effect of the oxidation of the caoutchin, the essential oil of caoutchouc. Vulcanization does not lessen the affinity of this substance for oxygen. The compounds used tend to fill the pores of the rubber and thus somewhat reduce the opportunity for oxidation, but the metallic oxides and other substances introduced in vulcanization and dyeing, including sulphuric acid from antimony sulphide — are often injurious, and boiling in caustic soda to remove the bloom left in goods by an excess of sulphur may cause injury. A comparison of analysis of the damaged rubber with those of the sound shows very large increase in the percentage of oxygen and some loss of carbon and sulphur. The hope is expressed that rubber may be produced synthetically ere long, thus removing our dependence on the present precarious source of supply.

Electricity on Shipboard.—In concluding a paper read before the Institution of Naval Architects of England Herr F. Eickenradt made the following remarks concerning the direct and alternating systems: In installations hitherto made continuous current has been exclusively used; it has proved completely efficient and there has been no occasion to discard it, as long as there was only a question of illuminating the interior and of searchlights. The latter can only be worked with continuous currents, otherwise their lighting power would suffer a decrease of about 40 per cent. As on men-of-war the consumption of energy for the searchlights reaches the considerable extent of 20,000 to 70,000 watts, it is evident that, for the kind of current required for for lighting the interior, and for several small motors, continuous current can only be utilized. The injurious influences upon the compass may be avoided, with such a current, by careful disposition of the conduits and the scientific construction and fitting up of the dynamo engines. But when it comes to a general introduction of electro-motors for working the auxiliary machinery, and a central station is erected for this purpose, which, like one already in construction in Germany, works with a power of 300,000 watts, the employment of continuous current offers considerable difficulties. In particular the motors placed on deck for the gun-turning apparatus and ship's winches have to be placed in such dangerous proximity to the compasses that the disturbing of the latter, in the case of parallel current, can hardly be prevented. For the working of this machinery, therefore, the use of the alternating current becomes unavoidable, as such a current, and likewise any motor driven by it, has no influence upon the compass. This, however, again necessitates the erection of two central stations, viz., one for the searchlights, and lighting with parallel current: and a second station, with alternating current, for driving the auxiliary machinery. Unfortunately this arrangement presents the great disadvantage that the motors of one station cannot be employed in support of, and in substitution for, those of the other, and that thereby a great complication would be created for the whole installation, which would demand greater capabilities from the crew. It will be impossible, however, to avoid this if the increased advantages, which the use of the electrical appliances affords on board of ships, are to be secured.

Influence of the Pelton Water Wheel.—The aid given by the Pelton water wheel to the development of electrical industries, says the American Machinist, is by no means small. The remarkable flexibility of this wheel by which almost any speed can be had, regardless of the head under which it works, or the power developed, is the fundamental reason of its usefulness. In consequence of this it is possible in a great many cases to make the speed of the wheel the same as that of the dynamo, and hence mount it on the same shaft. This construction is the one adopted at the Fresno, Cal., transmission, the wheels being there placed under the enormous head of 1,400 ft. The "Engineer" of London recently gave the Pelton wheel as one of several modern inventions which could not have been originated by a scientifically educated engineer. It operates on a principle which until recently was considered incompatible with high efficiency, and according to the "Engineer", required a mind free from the bias of theoretical training to recognize its possibilities. Its influence in developing the industries of the Pacific coast is almost beyond estimate.

A Novel Method of Removing Boiler Scale.—A correspondent of the Practical Engineer describes a novel method of removing boiler scale, as follows: "I have used turpentine on the scale with a sponge in the dark for fifteen minutes; then got out and applied a light, placed on the end of a 12 ft. bar, keeping myself well out of the boiler for safe y. I have done a day's work in half an hour. The instant heat of the turpentine shatters the scale immediately, and scarcely warms the boiler plate."

Injury to Boilers by Grease.—It has often been observed that small quantities of grease in combination with deposits lead to boiler accidents. This compound is deposited on the plates, and the most violent water circulation is sometimes insufficient to remove it. The plates, in consequence, get overheated and accidents arise. The introduction of grease inside the boiler should be avoided, especially where the water from the condenser is used for feeding the boiler, by the use of a sufficiently large feed water filter. The Berlin Boiler Inspection Society had the following case brought under its notice: Two single flued boilers, 4 ft. 8 in. in diameter, 23 ft. long, flues 28 to 22 in. diameter, pressure 12 atmospheres, were used to generate steam for a 150 horse power engine with surface condenser. The installation had only been in work since July 1893. A considerable portion of the flue of the left boiler had collapsed. This could not be attributed to shortness of water. On examination it was found that nearly all over the boiler a fatty brown slime had been deposited, which being placed on a red hot iron, burst into flame. The feed water pump got its water from a large open tank over which a small filter was placed. The condensed water was led to this filter in order to have the grease removed. Unfortunately, the arrangements were so bad that a considerable portion of the grease found its way into the boiler. A similar case was recorded by Mr. Abel at the last meeting of the Markisch Society for Testing and Inspecting Steam Boilers. Four boilers, the feed water of which was heated by the exhaust steam from a Westinghouse engine, after being in use about six weeks, were so damaged that one boiler had to be completely removed; the other three had to receive extensive repairs. An examination of the boilers showed that the flues were covered with a deposit of fatty slime. An analysis of this showed that about 52 per cent of it consisted of mineral oils and paraffin and 27 per cent of animal fat. It is strongly advised, therefore, that feed water shall always be filtered so as to remove any oils or grease.—Inst. C. E., Foreign Abstract.

Speed of Milling Cutters.—For the cutting speed of milling cutters in good German practice the following rule is given by the American Machinist: Revolutions per minute = C ÷ diameter of the cutter in inches. The value of C varies with the material. For cast iron or cast steel C= about 200, for wrought iron 200 to 240, for hard brass 320 to 340, and somewhat greater for soft brass. The resulting speeds are: For cast iron and cast steel 52 ft. per minute, for wrought iron 52 to 62, and for hard brass 62 to 89. The feed per minute for cast iron, wrought iron or steel is from 0.6 to 1.2 in., and for brass 2 in. or more. The classing of cast iron and steel together may seem strange, but probably a lubricant is used for steel and not for cast iron.

A Rapid Deep Sea Cable Repair.—A mid-Atlantic ocean repair on the Pouyer-Quertier cable was recently effected in a very expeditious manner by the Telegraph Construction & Maintenance Co. It was all the more creditable, as it was on the much dreaded Flemish Cap, a spot so well known by all Atlantic navigators, and, when possible, always avoided by them on account of its frequent fogs and incessant gales. According to the Electrical Engineer this company's vessel, the "Seine," raised the St. Pierre end on May 15, spliced on a piece, payed out and buoyed it the same morning. She then proceeded 40 miles to the eastward, and on May 17 raised the Brest end, spliced on, payed out, and arrived near the St. Pierre buoyed end the same night; but a dense fog coming on, the cable had to be cut and buoyed. The fog lasted four days, and on the weather clearing, the buoys were sighted, after some hours' searching for them. Early on the morning of May 22, the two ends were spliced together and the repair completed. This is claimed to be the quickest deep water repair ever made in the Atlantic, and had not the fog intervened, it would have been a marvelous one. The rapidity of the repair may have been aided by the fact of the "Francois Arago," which failed in repairing the break last winter, having left a mark-buoy, and this mark-buoy was sighted by, and served as a mark for the "Seine." The buoy which the "Francois Arago" had put on the St. Pierre end at the same time was not found by the "Seine." The break occurred in June, 1895, and another vessel went out last autumn, but returned without having effected the repair, although she cut into the cable to the eastward of the Flemish Cap. The "Seine" on her way out from London had effected considerable repairs, 235 miles from Brest, on the same cable. She left London April 25, called at Havre for cable, remaining there three days, and after effecting the two repairs above named, got back to London, May 30—exactly five weeks.

Automatic Coal Weighing Machines for Power Stations.—The late Hon. Eckley B. Coxe, who strongly advocated the substitution of a continuous record of actual boiler performance for the prevailing system of occasional tests, once stated the matter very tersely, saying according to Mr. F. H. Richards in Cassier's Magazine: "I am not so much interested in knowing what some expert may be able to do with my boilers as to know what work my firemen are actually getting from them every day." To know this, however, means the measuring of the intake and the output—means accounting for the entire supply and production, so that the necessary comparisons may be made for formulating the result. The automatic weighing machine supplies this requirement, automatically handling coal and water, much after the manner of an ordinary water meter, say, interposed in a water pipe or a gas meter for that matter, giving a continuous and reliable record of what has passed through it. In another way, too, may the automatic weighing machine serve a good purpose. Daniel Webster has been quoted for the way in which, in one of his speeches he emphasized "the tremendous power of six per cent." Certainly the investor of to-day looks sharply enough to the difference of one per cent. in the rate of interests chargeable against him. But does he look as closely to the other components of the "cost?" For instance, recent experiments indicate that the anthracite coal generally used for steam making will hold about 4 per cent of water without much dripping; and much of that coal is "watered" to this extent before delivery. If, now, the coal pile be replenished twice a year with wet coal, it is evident that the buyer pays the interest rate, plus 8 per cent of the purchase price as the cost of the capital employed in "carrying" the fuel account. Although the coal cannot, for obvious reasons, always be obtained dry, the drying may be readily effected in nearly all power stations before the coal reaches the bins by using heated air drawn from the upper part of the boiler rooms. Then by weighing in through an automatic weigher and reweighing in the same way, first to bins and next directly to the furnaces, all of the required facts are obtained. The first weighings, by showing the amounts taken in and delivered to the bins indicate the evaporation, and a comparison of the records of the second and third readings will show, at any time, the amount held in storage in each bin, besides giving the amount chargeable to each set of boilers.

Electric Transmission on the Pacific Coast.—The incorporation of the Pacific Transmission Company of San Francisco, marks the beginning of an interesting project for the electrical transmission of power from the mouth of California coal mines. The company will be controlled by the San Francisco & San Joaquin Valley Coal Company, whose mines are at Corral Hollow in Alameda county and is one of several important undertakings connected with that corporation. The new company, says the Electrical Engineer, will have a capital of $3,000,000, and will be empowered to build and operate steam and electric plants at the coal mines in Corral Hollow and Alameda country for the purpose of generating electrical power and furnishing the same by transmission over wires to Oakland by way of Livermore, Haywards, San Leandro and other towns en route, and also to San Jose and to Stockton. It is intended to ultimately extend the service to San Francisco. The cheapest item connected with the generation of electrical power will be the fuel, which will consist of the waste and refuse screenings, dust, etc., from the coal produced at the extensive Corral Hollow mines. The supply of this kind of fuel will be almost inexhaustible, and as it is extracted from the mines with the merchantable coal, it is all paid for by the latter. As the coal company will control the transmission company there will be no charge for this fuel. The plant at the mines will generate at the start 6,400 horse power of which about 5,000 horse power will be supplied to San Jose and to Oakland, through the towns en route, and afterward Stockton will be taken in, and if necessary the supply can be increased so as to extend the service even to San Francisco and other more distant points. The company expects to furnish this power to Oakland, San Jose, Stockton and intervening places at $60 per horse power per year. The present cost ranges from $60 to $80, according to conditions.

Tests on Heavy Motor Cars.—Early in this year two students at Cornell University conducted a series of tests on the Buffalo & Niagara Falls Electric Railway the results of which were presented in the form of a graduating thesis. The results of the tests and diagrams illustrating them were published in the Street Railway Review. The type of car on which the tests were made has a 28 ft. body mounted on double trucks. It is 36 ft. over all and 8 ft. wide. The seating capacity is 44. The greatest peculiarity of these cars is that they have a motor on each of the four axles. The motors are G. E. 800, but during the past winter these were found to be too light and are being changed for G. E. 1000. The weight of car is 30,515 lbs. When out on the open country as during the tests the controllers of these cars are connected to start the cars with motors two in series and two in parallel, changing before full speed is reached to all four in parallel. The results of the complete series of tests are summed up in the following averages:

Average friction of car, equivalent draw-bar pull	208.5 lbs
Average traction co-efficient, pounds per 1,000	6.86 lbs
Average acceleration horse power (this is not the actual electric horse power expended)	16.02

Average mechanical efficiency of car on straight level track at constant speed	63.37 per cent
Average voltage on line from several runs	513.10
Average current taken on trip over entire line	63.4 amperes
Average electrical horse power of car over entire line	40.44
Average speed in miles per hour	23
Maximum current taken by car during tests	188 amperes
Maximum pressure at car during tests	583 volts
Maximum electrical horse power of car during tests	143
Maximum speed in miles per hour on regular run	36
Maximum speed attained in miles per hour	42

M. C. B. RULES FOR LOADING STRUCTURAL MATERIAL.

In the issue of last week the rules were reproduced which were recently adopted as recommended practice by the Master Car Builders' Association for the loading of lumber, and those which apply to the methods of loading other structural material are given below, together with the diagrams which accompany the rules. Copies of the complete rules may be had from Mr. J. W. Cloud, secretary of the association:

GENERAL INSTRUCTIONS.

1. On account of the great variety of form and weight of long structural material, no general rules can be made to suit all cases. The following regulations are, therefore, intended to cover only the most common forms. When material cannot be loaded in accordance with these regulations, special instructions must be asked for.

2. Cars to be used for shipments of this character must be carefully examined before loading, and all defects must be remedied before the cars are loaded. Great care must be taken not to overload cars, and in the case of very long or very heavy material the truss rods should be screwed up tight. The weight of the lading carried on any car must be governed not only by the marked capacity of the car, but also by its general construction, as well as by the number and location of the bearing pieces upon which the load rests. The regulations covering these points are given in the detail instructions for each form of loading, and must be strictly adhered to. The only exceptions are cars which have been specially prepared for the shipment of particular forms of material.

3. Material over 40 feet long carried on two or three cars must always be examined by a competent inspector before the cars are moved from the loading point. If no inspector is stationed at the loading point, the local agent must give notice to the proper authority when the cars are loaded, so that proper inspection can be arranged for. The object of such inspection is to see that these regulations have been complied with.

4. Standing room of at least 18 in. must always be left around brake shaft at one end of the car to permit the

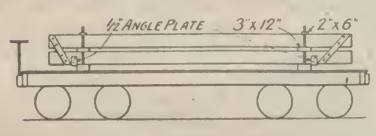


FIG. 1.

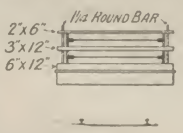


FIG. 2.

proper operation of the brake, and at the other end of the car, when a single car is used, the lading must not project beyond the end sill, except in the following case: When the lading is too long to go inside the car, but will not extend more than 6 in. beyond the end sill, such method of loading will be permitted, providing the projection ends of the material will clear 6 ft. 6 in. above the rail.

5. In all other cases when the lading extends beyond the end sill of the car, an idler must be used or the material must be loaded on two or three cars, as the case may demand, and as explained under "Detail Instructions" below.

6. Long iron, rails, bridge material, channels, angle irons, etc., should, whenever possible, be loaded on single gondola cars inside the end gates, which must in all cases be raised and securely fastened. Single flat cars must not be used for rails or bar iron, unless furnished with substantial end boards to prevent shifting of the load.

7. Whenever the lading is carried by more than one car, all slack between cars must be removed by the use of spacing blocks in the manner described in "Detail Instructions." Cars must also be chained together in order to prevent parting in case of failure of the couplings. When cars are used which are not permanently equipped with safety chains, chains made of not less than three-quarter inch iron must be passed around the body bolsters and across under sills, forming a loop back of bolster and doubling to point of coupling between the two cars and so tie them together. These long chains must only have a sufficient amount of slack to permit the cars to curve. At interchange points chains will either be removed, or the receiving road will furnish the delivering road with chains of the same quality and dimensions as those received.

8. When either one or two bearing pieces are required, they must never be placed between the bolster and the end of the car, but either between the bolsters or directly above the bolsters. When only one bearing piece is used on a car, as in Figs. 13 and 14, it must be placed at a distance of at least 12 in. from center of bolster toward center of car.

9. All spacing blocks between cars, bearing pieces, spacing blocks between material, clamping pieces, bolsters and all braces must be of hard wood and sound in every way. Dimensions given are, however, intended to be general only, and any material that may be suitable for blocking, but which differs in dimensions from figure given, but which is of equal strength or stronger, may be utilized.

10. Hight and width of lading must be governed by tunnel and bridge limits of roads over which lading is destined.

11. When two or three cars are used, cars carrying load must be considered of the same capacity as the one of lesser capacity.

DETAIL INSTRUCTIONS.

LOADING OF SINGLE CARS WITHOUT IDLERS.

12. Large girders loaded on flat side on flat cars must always be carried upon bearing blocks not less than 4x12 in., which must be placed one over each bolster and secured to the floor with two ⅞ in. bolts. When two or more

FIG. 3.

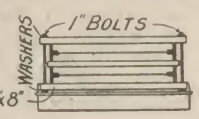


FIG. 4.

large girders are carried on a flat car the bearing blocks must not be less than 6x12 in., and fastened in the same manner to the floor. In addition, spacing blocks not less than 3x12 in. must be placed between each girder. Lateral motion must be prevented by means of upright iron stanchions driven into holes in the bearing pieces, and held together at the top by not less than 2x6 in. planks, as shown in Fig. 2, or it may be prevented by fitting planks between flanges of the girders, as shown in Fig. 3. To prevent longitudinal motion angle plates 5 or 6 in. wide by ½ in. thick must be bolted firmly to the lower girders close to the bearing pieces, as shown in Fig. 1, or if rivet holes are not available it may be prevented by clamps, as shown in Fig. 4. The upper girder must be held to the lower girder by diagonal flat iron braces bolted to both girders, as shown in Fig. 1. If, however, girders are clamped together as shown in Fig. 4 the diagonal flat iron braces need not be applied.

LOADING OF SINGLE CARS WITH IDLERS.

13. When the lading is too long to go inside of a car and extends more than six inches beyond the end sill, such loading will be permitted if an idler or idlers are provided to protect the overhanging part of the loads, as in Figs. 5, 6 and 8; but in these cases the length of the permissible overhang must be governed by the width of the lading and the hight above the rail, and it must in no case exceed the figures given below, which are based on clearance required on a 20 deg. curve, it being understood that the load must be placed centrally on the car and the amount of overhang measured from center of bolster on the carrying car.

For loading in accordance with Figs. 5, 6 and 8:

8 ft. wide	10 ft. overhang.
7 ft. wide	14 ft. overhang.
6 ft. wide, or less	18 ft. overhang.

14. To prevent overloading of the truck under the overhanging ends, as shown in Figs. 5 and 6 the carrying capacity of the car will decrease in the following manner as the length of the overhang increases:

For overhang not exceeding 5 ft., car may carry full marked capacity.

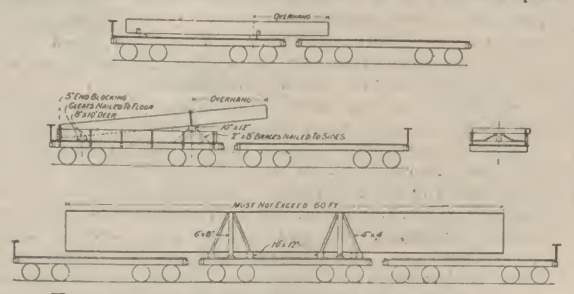
For overhang not exceeding 10 ft., car may carry three-fourths of the marked capacity.

For overhang greater than 10 ft., car may carry one-half the marked crpacity.

15. (a) The idlers used with loads as shown in Figs. 5 and 8 must be flat cars unless the width of the overhanging part of the lading is at least 3 ft. less than the width given for each length of overhang in the table in paragraph 13, in which case drop-end gondola cars may be used.

(b) The idler used with loads as shown in Fig. 6 may be a low-side gondola, but must not be a high-side gondola car.

16. The idlers may be loaded with any suitable material, provided the consignee and the destination of the material on all cars are the same. There must be, however, a space



FIGS. 5 TO 8.—STRUCTURAL MATERIAL.

of at least 2 ft. between the ladings on the carrying car and the idler. The carrying capacity of the idler depends upon how far the overhang extends over the idler, and must not exceed the following figures, except with ladings as in Fig. 6, in which the overhang may be so far above the floor of the idler as not to interfere with its lading. In such cases the idler may carry full marked capacity.

When overhang does not extend over idler more than 5 ft., full marked capacity.

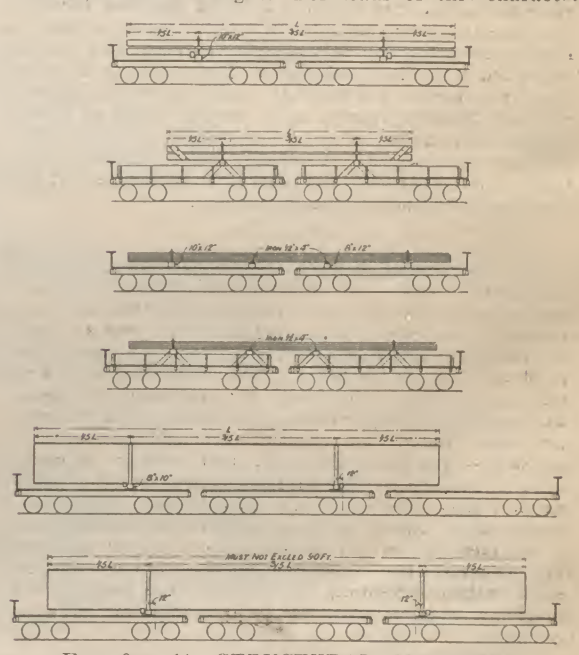
When overhang does not extend over idler more than 10 ft., three-fourths of the marked capacity.

When overhang extends over idler more than 10 ft., one-half of the marked capacity.

17. When large girders are loaded, as shown in Fig. 5, they must be secured to carrying car, as explained in paragraph 12.

18. When material is loaded on gondola cars and is longer than the body of the car, as shown in Fig. 6, one end must rest on a bearing piece not less than 10x8 in., placed on the floor above the bolster and extending the width of the car. It must in all cases be of sufficient depth to prevent the lading at this end from touching the floor of the car. It must be secured from shifting by cleats nailed to the floor. The end boards at this end of the car must be protected by blocking not less than 5 in. thick, fitted snugly between the side boards and extending upward to a hight sufficient to prevent all parts of the load from touching the end boards of the car. The other end of the load must rest upon a bearing piece, square or round, preferably square, not less than 8x10 in. if square cornered, nor less than 10 in. in diameter if round. This bearing piece must rest upon the side boards of the car directly above the bolster, and it must be securely braced to prevent both lateral and longitudinal motion, and if round it must also be braced against rolling; it must also be supported from bending. Figs. 6 and 7 show substantially how both bearing pieces are to be secured. To prevent the load from shifting in a lateral direction on the bearing piece, iron stanchions tied together with a plank at their upper ends must be used as described in paragraph 12.

19. A method of loading especially adapted to long lattice girders, which may be injured if loaded on more than one car, is shown in Fig. 8. For loads of this character



FIGS. 9 TO 14.—STRUCTURAL MATERIAL.

four bearing pieces must be placed in pairs on the carrying car, each pair being placed centrally above the bolster, with a distance apart of not over 5 ft. nor less than 3 ft.; they must be fastened to the floor with bolts, as explained in paragraph 12, and the upright supports must have side braces. Braces or tie rods must be secured to the overhanging ends and to the bearing pieces, as shown in Fig. 17. Longitudinal motion must be prevented by the use of plates or clamps, as explained in paragraph 12.

LOADING OF TWO OR THREE CARS WITH OR WITHOUT IDLERS.

20. Material which in length exceeds the limits given for the loading of one car must be loaded on two or three cars, as shown in Figs. 9, 10, 11, 12, 13, 14, 15 and 16. With loads of this character the lading must never exceed maximums given in paragraph 26. The carrying cars must always have all slack between them removed by the use of spacing blocks, as described in detail in paragraph 28, and the cars must be chained together, as explained in the "General Instructions," paragraph 7.

21. Material loaded on gondola cars with drop ends or open ends or on flat cars, as is shown in Fig. 9, must have one bearing piece not less that 10 in. wide by 12 in. deep secured to the floor of each car with two ⅞ in. bolts. Lateral and longitudinal motions must be prevented in the manner described in paragraph 12. In the case of gondola cars, a clearance of at least 18 in. between the load and car sides must always be provided for curving.

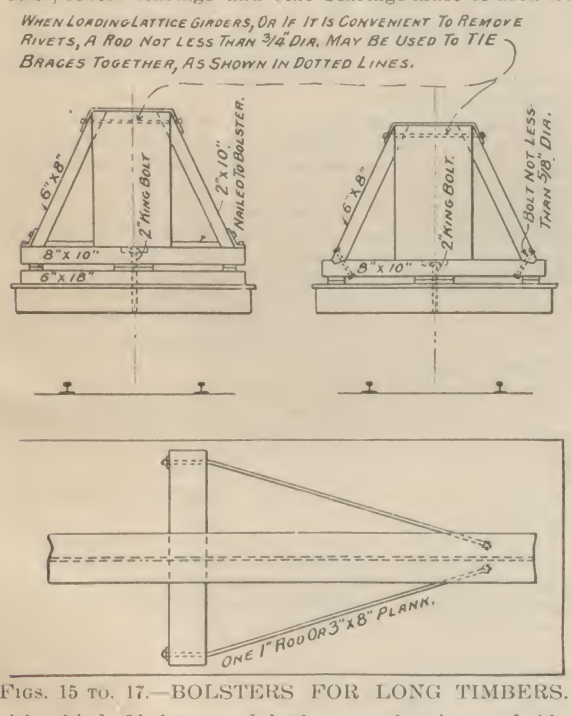
22. Material loaded on gondola cars without drop end doors, as shown in Figs. 10 and 12, must have bearing pieces placed on the top of the side boards, of the same size and secured in the same manner as described in paragraph 18. The lading must be secured from lateral and longitudinal motions as described in paragraph 12.

Long flexible material, like plates, etc., must be loaded on four bearing pieces, as shown in Figs. 11 and 12. The two center bearing pieces, must however, be two inches lower than the end pieces and have flat iron ½ x 4 in. secured on the upper side, either with spikes having countersunk heads or with two ½ in. lag screws at each end; these iron pieces, which are intended to facilitate curving, must extend at least one foot beyond each side of the lading and must be coated with grease. The bearing pieces must be secured to the car, and the material clamped together to prevent it from shifting, in the manner described in paragraps 12 and 18. If loaded in gondola cars with drop end doors, the same clearance must be provided between lading and car sides as specified in paragraph 21.

(If more than four bearing pieces are required to properly support the lading, the center pieces on each car must be provided with upright stanchions, as in paragraph 12; all other bearing pieces to have flat iron secured to their upper sides to allow for curving, as provided with four bearing pieces.)

24. Large girders loaded on edge, as shown in Figs. 13,

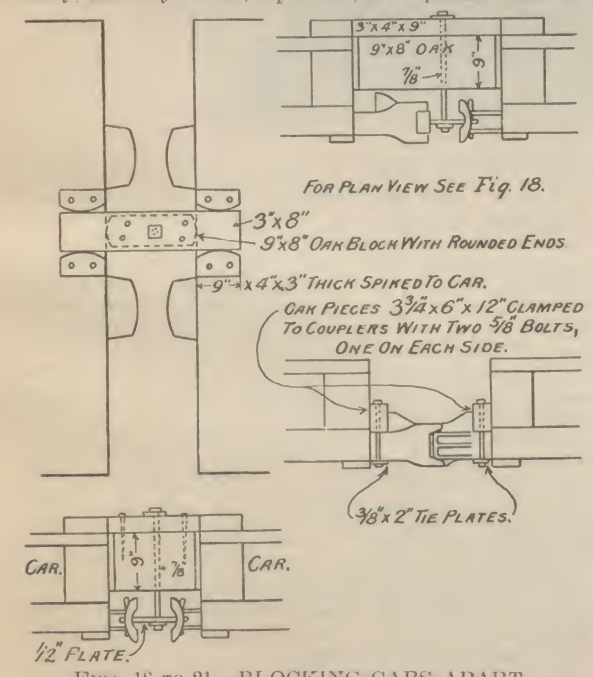
14, 15 and 16, on two or three cars, either with or without idler, must be supported on two swiveling bolsters, which may be constructed either as a double bolster (Fig. 15) or a single bolster (Fig. 16.) The double bolster is preferable for wide and heavy loads on account of the better distribution of the load over the car stringers, and must always be used when the width of the lading exceeds 3 ft. or its weight exceeds one-half the marked capacity of the car. Deep girders which cannot be loaded on double bolsters without exceeding the limit in hight in paragraph 13, and low girders less than 3 ft. wide may be loaded on single bolsters, provided that the weight carried by each car does not exceed one-half of its marked capacity. When double bolsters are used, the lower piece must be securely fastened to the car floor, as described in paragraph 12, and must be not less than 6 in. deep by 18 in. wide. King bolts, center bearings and side bearings must be used for



FIGS. 15 TO. 17.—BOLSTERS FOR LONG TIMBERS.

either kind of bolster, and both center bearings and side bearings for the upper bolster must move on corresponding bearings, secured either to the lower bolster or to the floor of the car, as the case may be. When wrought iron plates are used for side bearings with single bolsters, the lower plate must be fastened to the car floor with countersunk screws or with two lag screws at each end, placed at least 12 in. away from sides of bolsters. The girders must also be secured to the upper bolster with diagonal tie rods or braces, as shown in Fig. 17; if braces are used they must be not less than 3x8 in. Diagonal side braces must be used between the top flange of the girder and the outer ends of the top bolster, as shown in Fig. 15 and 16. When the lading consists of two or more girders standing side by side or lying on their sides, they must be securely fastened to each other, as described in paragraph 12.

25. The location of the bolsters depends upon the length and the width of the girders, as well as upon their stability, and they should, if possible, be so placed that the



FIGS. 18 TO 21.—BLOCKING CARS APART.

length of each overhanging end is not more than one-fifth, and the distance between the bolsters not less than three-fifths, of the total length of the girder. The following table gives locations of bolsters for girders of maximum length and width, based on clearance required on a twenty degree curve:

60 ft. long by 8 ft. wide or less, bolsters not less than 36 ft. between centers.

70 ft. long by 7¼ ft. wide or less, bolsters not less than 42 ft. between centers.

80 ft. long by 6½ ft. wide or less, bolsters not less than 48 ft. between centers.

90 ft. long by 5½ ft wide or less, bolsters not less than 54 ft. between centers.

In cases of material of less width than 5½ ft. but of greater length than 90 ft., application must be made to the proper authority for special instructions.

26. To prevent overloading the following regulations must be adhered to:

(a) When only one bearing piece is used and its location is near the center of the car, as in Fig. 9. Flat cars having only two truss rods, weight of lading must not exceed one-half of marked capacity of car, Flat cars having more than two truss rods, also low-side gondola cars, weight of lading must not exceed two-thirds of the marked capacity of car.

(b) When only one bearing piece is used and it is located about equal distance from center of car and center of truck, as on end car in Fig. 13. Flat cars having only two truss rods, weight of lading must not exceed two-thirds of marked capacity of car. Flat cars having more than two truss rods, also low-side gondola cars, weight of lading must not exceed three fourths of marked capacity of car.

(c). When only one bearing piece is used, and it is located at or near the center of the truck, as on center car in Fig. 13, and on end cars in Fig. 14, or on top of sides on high-side gondola cars in Fig. 10, the weight of the lading must not exceed one-half of the marked capacity of the car.

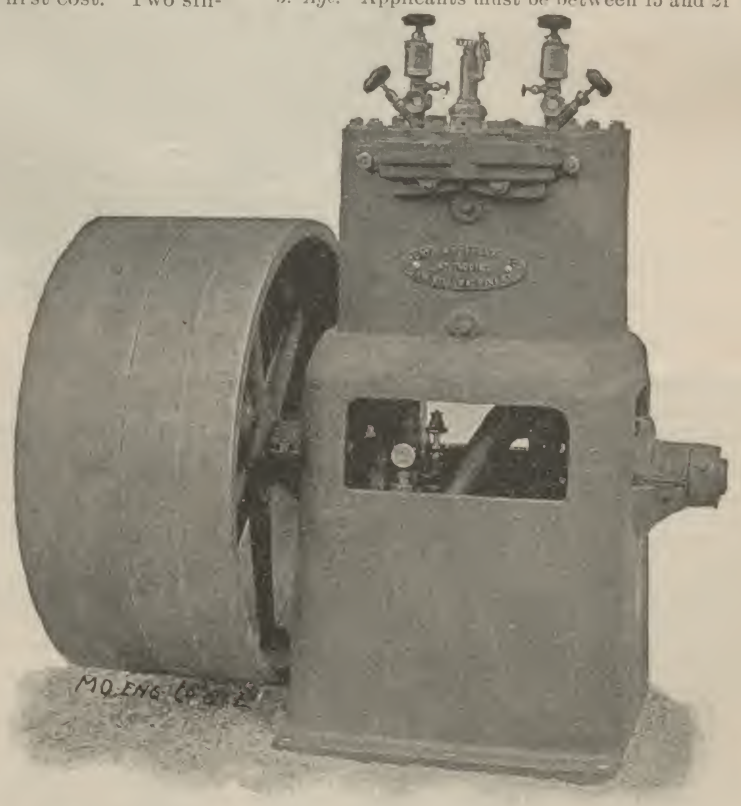
(d). When more than one bearing piece is used on each car, as in Figs. 11 and 12. Flat cars and low-side gondola cars, weight of lading may equal marked capacity of car. High-side gondola cars, weight of lading must not exceed three-fourths of the marked capacity of car.

27. The selection of cars to be used as idlers with loads, as shown in Figs. 13 and 14, must be governed by paragraph 15 (a).

28. The method of blocking cars apart, to be used when a load is carried on two adjacent cars, or when it is carried on two cars separated by an idler, is shown in Figs. 18 to 21, inclusive. Figs. 18 and 19 represent both the cars with ordinary drawheads. Fig. 20 represents one car with M. C. B. coupler and the other car with ordinary drawhead. Fig. 21 represents both cars with M. C.B. couplers. In blocking cars apart they must first be separated by means of jacks until all the slack in the springs, couplers or links, if the latter are used, has been taken up; the spacing blocks must then be neatly fitted between the cars and secured in the manner shown. All wood used must be sound oak.

BELTED AIR COMPRESSOR.

The accompanying illustration gives a good idea of a belted air compressor which is being placed on the market in small sizes by the Curtis Mfg. Co., of St. Louis, Mo. The machine is designed for furnishing small quantities of compressed air economically and with a small outlay in first cost. Two single acting cylinders are used and are cast in one piece with the bed and journal bearings. The valves are four in number, an independent admission and discharge valve being used for each cylinder. These are of the most simple form, circular in shape. They open and close by the action of the air without the aid of springs. The admission valves are both enclosed in one small casting bolted to one side of the cylinders, and the discharge valves in a second casting of similar form bolted to the opposite side. That containing the admission valves is shown in the illustration and attached to it can be seen the pressure regulator, which is an exceedingly ingenious and effective attachment. It consists of a small valve connected by a pipe with the reservoir into which the compressor pumps and when the pressure reaches the point at which it is set the admission valves open. This is accomplished by means of two small levers shown in the illustration, and which hold them open as long as the pressure does not decrease. The regulator can be adjusted by turning a thumb screw and may be secured by a lock. It is stated that this device will prevent the pressure from varying more than half a pound, and such an attachment to a belted compressor is almost indispensable.



A water jacket is provided and in the shops of the manufacturers it is found that the necessary supply is easily carried in a small circular tank secured to the wall, and that the change in temperature will cause all the circulation necessary. With this type the area of the cylinder in proportion to the amount of air compressed is so large, that the temperature of the cylinder never reaches as high a point as when a double acting cylinder is used, and therefore a less amount of water will effect the cooling. A very heavy fly wheel is provided. In the construction jigs and templets are used for insuring an interchangeability of parts.

APPRENTICE SYSTEM—UNION PACIFIC RY.

Through the courtesy of Mr. J. H. McConnell, superintendent of motive power and machinery of the Union Pacific Railway, we are enabled to reproduce the rules which are in effect upon that road governing the administration of the apprentice system. This code was introduced upon the road in 1887, and originated during the time when Mr. Clem Hackney was superintendent of motive power. It has been in force ever since the date mentioned, and the fact that the rules have remained exactly as they were originally and that no changes have been considered desirable, attests their careful and satisfactory construction. Mr. McConnell is a student of the subject of the management of men, and while others are having considerable difficulty in obtaining good foremen and even good ordinary workmen, he seems to be reaping the benefit of this system in getting plenty of both. The rules are printed in pamphlet form and are reproduced in full, together with the introductory paragraph, which is as follows:

With a view to promoting the interests of employes and securing a higher standard of excellence in the company's service, the following regulations governing the appointment and service of apprentices in the machinery and car departments of the Union Pacific Railway Company are announced, superseding all previous regulations in conflict therewith:

REGULATIONS.

1. Form of Application.—Candidates must make application for admission to apprenticeship in their own hand writing, and execute Apprentice's Release, which will be enclosed to the master mechanic of division, or to superintendent motive power and machinery.

2. General Requirements.—Candidates must possess a natural aptitude for mechanics, and have a settled personal desire and purpose to become skillful and competent workmen.

3. Age.—Applicants must be between 15 and 21 years of age at date of application. No others will be considered.

4. Physical Requirements.—Candidates must be physically sound, of robust constitution, and free from any deformity, hereditary or acquired tendency to disease or infirmity, which might render them unfit for the laborious service of the company.

5. Educational Requirements.—Candidates must be well trained in reading, writing, spelling and arithmetic, and have a knowledge of the elements of English grammar, physical and descriptive geography, freehand drawing, and the history of the United States.

6. Examination.—Candidates will be examined: 1. By two medical examiners, to be designated by the chief sur

geon of the railway company, whose decision as to their physical qualifications will be final. 2. By one or more instructors, to be designated by the superintendent of motive power and machinery, whose decision as to their educational qualifications shall also be final.

7. *Meetin s of Examining Boards.*—The two examining boards will meet at least once every three months, if there are places to fill, at such points on the line of the company's railway as may be expedient, timely notice of which will be sent to all accepted applicants. Candidates failing to pass the physical and medical requirements cannot apply for re-examination, and those failing in educational requirements cannot apply for re-examination for three months after rejection.

8. *Preference in Appointment.*—Other things being equal, preference in appointment will be given to sons of employes of long and faithful service and especially sons of employes killed, injured or disabled in the service of the company.

9. *Assignment to Probationary Class.*—Candidates will first be assigned to the probationary class in the order of seniority of examination, and according to the standard of excellence attained in the examination they have passed, and as vacancies occur will be assigned to the particular branch of mechanics in which they show inclination or aptitude, and in which, as determined by their examination, they are the more likely to succeed.

At the expiration of three months, candidates in the probationary class will be re-examined, and those passing will receive a commission as apprentices in the 6th class. Those who fail to pass the second examination will be given three months additional in the probationary class, and failing of promotion a second time, must give up their place, and will not be again eligible.

Candidates found on second examination to be exceptionally advanced or apt, will be furnished special opportunities for technical instruction, and may be advanced in classification according to their merits, upon recommendation of the examining boards and approval of the superintendent of motive power and machinery.

As the report and finding of the examining boards will be final, and as a sound body and constitution, good natural capacity and aptitude for study, industrious habi s, perseverance and an orderly disposition, together with correct moral deportment, are essential qualifications.candidates knowingly deficient in any of these respects should not subject themselves and friends to the chances of future disappointment by entering upon a career which, lacking these qualifications, they cannot successfully pursue. It is, therefore, suggested to candidates for admission to the company's service, that before leaving their homes they should have themselves examined by a physician and by an instructor of good standing. By such an examination any physical disqualification or want of educational preparation would be revealed and the candidate spared the expense and mortification of a useless examination and rejection. It is to be understood, however, that such examination is solely for the convenience and benefit of the candidate, and in no manner affects the decision of the examining boards.

10. *Classification.*—The term of service of apprentices will be four years, dating from the first day of the month in which they enter the service. The classification and pay until further notice will be as follows, subject to revision and change at the option of the company, 30 days notice of proposed change to be given in all cases:

CLASSIFICATION AND SCHEDULE OF PAY NO. 1.

Class.	Term of Service.	Rate per day.
Probationary	First 3 months	$ .50
Sixth	Second 3 months	$0.50
Fifth	Second 6 months	$0.75
Fourth	Third 6 months	$1.00
Third	Fourth 6 months	$1.25
Second	Third year	$1.50
First	Fourth year	$2.00

The compensation and classification of apprentices now in the service will be made to conform to the above classification, schedule and regulations as closely as practicable to date from October 1, 1886, and in accordance with the following schedule, but it is not intended to work a reduction of pay in any case.

Those now receiving the various grades of pay designated below will be considered as in the following classes, graded according to pay.

Grades of present pay per day.	*Class*
$0.50 and less than $0.75	Sixth
$0.75 " " $1.00	Fifth
$1.00 " " $1.25	Fourth
$1.25 " " $1.50	Third
$1.50 " " $1.75	Second
$1.75 " " $2.00	First

11. *Discipline*—Apprentices will be subject to the discipline of the company, and violations of its rules, neglect of its interests by inattention to duties, unsatisfactory work or other deficiencies will be cause for dismissal. While liable to suspension by their immediate official superiors, apprentices will not be dismissed from the service, except upon order of the superintendent of motive power and machinery, whose decision will be final.

12. *Certificate of Service.*—Apprentices are not bound by indenture, but those who complete satisfactorily the term of service for which they are engaged will be given certificate of service, character and ability.

13. *Continuance of Service.*—The company cannot guarantee continuance of service during the full term of apprenticeship, but will endeavor to regulate admission to this service so as to avoid as far as practicable the necessity of reducing the force of apprentices.

ILLUSTRATION OF CHARACTER OF EXAMINATION.

Physical Examination.

Every candidate will be subjected to a rigid physical examination, and if there is found to exist in him any of the following causes of disqualification, to such a degree as would immediately or at no distant period impair his efficiency for the active service of this company, he will be rejected.

1. Feeble constitution and muscular tenuity; unsound health from whatever cause; indications of former disease; glandular swellings or other symptons of scrofula.
2. Chronic cutaneous affections, especially of the scalp.
3. Severe injuries of the bones of the head; convulsions.
4. Impaired vision from whatever cause; inflammatory affections of the eyelids; immobility or irregularity of the iris; fistula lachrymalis, etc.
5. Deafness; copious discharge of the ears.
6. Serious impediment of speech.
7. Want of due capacity of the chest, and any other indication of a liability to pulmonic disease.
8. Impaired or inadequate efficiency of one or both of the superior extremities on account of fractures, contraction of a joint, deformity, etc.
9. An unusual excurvature or incurvature of the spine.
10. Hernia.
11. A varicose state of the veins of the scrotum or spermatic cord (when large) sarcocele, hydrocele, fistula.
12. Impaired or inadequate efficiency of one or both of the inferior extremities on account of varicose veins, fractures, malformation, permanent lameness,contraction, unequal length, etc.
13. Ulcers or unsound cicatrices of ulcers likely to break out afresh.

Educational Examinations.

1. *Reading.*—A short selection will be taken from some standard author, such as Dickens, Scott. Longfellow, Tennyson, Macauley, Burke or Webster; also a passage from a newspaper or magazine. Ability to read clearly, understandingly, and correctly is all that is required.

2. *Writi g.*—Sentences will be dictated for writing. Neat and plain penmanship, legible and devoid of flourishes, is essential. A proper use of capitals and punctuation marks will constitute one-third of the requirements of this branch. Ability to read another's handwriting is also essential.

3. *Spelling.*—Words like the following will be given: telegraph, dispatch, convenient, ambitious, atmosphere,transportation, injector, lubricate, cylinder, turning lathe, piston rod, mechanical, corrosion,, diagram, Supt., c. g., viz., per diem, qr., gr., N. J., Mo., Co. It will be observed that words in common use, railway and transportation terms, and technical expressions used in mechanics or names of parts of machinery, will cover the ground required.

4. *Arithmetic.*—1. The surface of Ohio is 40,060 square miles. Counting it all land, worth $52.00 per acre, what would the tax on the whole be at 12 miles on the dollar if the land is assessed at ¾ its value?

2. Solve these ratios: 118 : 16, 16 : 128, ⅜ : ½, ½ : ⅜.

3. A piece of rock weighed on a certain scale is 1,200 tons. What is the true weight provided 100 lbs. by this scale is 99 lbs. by a true scale.

4. A note for $1,050.96 is given February 29, 1880, interest at 7 per cent. The endorsements are April 10, 1881, $200.00; June 1, 1883, $40.20; what is due December 31, 1883.

5. Write a promissory note, given by John Doe to Richard Roe.

6. A, buys 10 shares, of $100.00 each, Union Pacific at 59, and sells same a year later at 65, brokerage being ⅛ per cent in each case, the stock paying no dividend, and current rate of interest being 5 per cent. Did A make or lose, and how much?

7. Find the square root of 39½ to four decimal places.

8. B owns 100 U. S. 5-20 bonds: what is his income therefrom per minute?

9. How many miles per hour is an engine traveling whose driving wheels are 5 ft. 10 in. in diameter and are making 1¾ revolutions per second? (Circumference to diameter, 3 1-7 to 1.)

10. If a rail, weighing 62 lbs. per lineal yard, 25 ft. long, is carried by four men, A, B, C and D, A and B, being 5 ft. from one end, and C and D, 10 ft. from the other, what proportion of total weight do A and B carry?

Proficiency in arithmetic is highly important: the subject of proportion, decimals, fractions, tables of measure and quantity, parts and properties of triangles and circles will receive special attention.

5. *Grammar.*—In English grammar the candidate must be able to define and illustrate the parts of speech, gender, number and case, to parse, and to write good plain English. Incorrect expressions will be given for correction. An essay will be required on some such subject as the following: The Use of Steam, The Missouri River, Our Public School System, Abraham Lincoln.

6. *U. S. History.*—Causes and results of the Mexican war. Origin and construction of the Union Pacific Railway. The great inventors of our land. What nations settled this country? Date and circumstances of admission of Kansas, Nebraska, Kentucky, Colorado, Missouri and Alabama to the union.

7. *Geography.*—Principal river in North America. In sending livestock from Denver to Liverpool, over what lines or systems of railway may you ship it? Bound New York, Tennessee, Idaho. Locate Glasgow, Moscow, Isthmus of Panama, Baltimore, Mt. Washington, the Cascade range, Plymouth Rock and Salt Lake City.

8. *Physical Geography.*—Why are England and Oregon warmer than places in the same latitude on the east coast of America? What is a "storm centre" and how does direction of wind differ therefrom at circumference? Why does falling Barometer indicate a storm? Why does water boil easier in Denver than in Kansas City, and why is it colder on top of a mountain than at its foot? Define and describe Torrid Zone, mirage, trade, wind, sheet lightning and volcano.

9. *Drawing.*—Proficiency in this art is of great service to the apprentice, although not absolutely necessary to pass the examination. Candidates ability will be tested in free hand drawing of some simple part of machinery or of railroad engineering work.

Above is only an illustration of the kind of questions that will be asked. Examiner will vary therefrom as he sees fit. He will also use his own judgment as to what part of the examination shall be written and what oral, preference being given to the former while either may be used.

FORM OF APPLICATION FOR ADMISSION TO APPRENTICESHIP.

(*Must be made in handwriting of applicant.*)

Date..... 18

Name in full.....

Date of birth.....Place of birth .....

Father or guardian's name and address.....

A HEAVY PITTSBURGH COMPOUND LOCOMOTIVE—PITTSBURGH LOCOMOTIVE WORKS.

Relatives now in service of the U. P. Ry. Co.? In what capacity and under whom employed? Synopsis of their service record? .....

Schools in which educated (specifying time in each and date of leaving last school)? .....

Name of last principal or head teacher and his address for reference? .....

Where employed heretofore? By whom (giving address of employer) and character of employment? .....

Names and addresses of two gentlemen, not relatives, to whom reference can be made as to character and ability? .....

Trade or branch of railroad work the applicant desires to learn .....

Location of shops preferred .....

I have read the regulations under which apprentices are employed in the service of the Union Pacific Ry. Co., and if accepted I hereby agree to conform to and abide by all rules and regulations made by the said company for the government of apprentices in said company's service, now existing or hereafter made, and to serve the full term provided for therein; unless said service is sooner terminated in pursuance of said rules and regulations.

.....

Signature of Applicant.

I desire that my..... shall become an apprentice of the Union Pacific Ry. Co. under the terms and regulations specified in rules issued by the superintendent of motive power and machinery, of that company, hereto attached, and give my consent to his accepting the same.

.....

.....

Signature of Parent or Guardian.

APPRENTICE'S RELEASE.

WHEREAS ..... a minor, aged.....years, has made application to the Union Pacific Railway Company for employment as an apprentice, under the terms and conditions set forth in Regulations issued by the Superintendent Motive Power and Machinery of the Union Pacific Railway Company (copy attached hereto) and

WHEREAS .....the father (or legal guardian) and ..... the mother of said minor ha.... given .... consent to said employment and agree ...to waive and release said Union Pacific Railway Com- from any and all rights ..... might otherwise have to sue and recover damages on account of any injury the said minor may receive in the course of said employment by said company.

NOW, THEREFORE, ... the father (or legal guardian) and ..... the mother, in ..... several and individual capacities, and acting as guardian for the said ..... and the said ..... himself in consideration of the employment of said minor as above, do hereby forever release and discharge the Union Pacific Railway Company and its auxiliary companies from any and all claims and liability for damages resulting from injuries which may be received by said ..... while in the employ of the Union Pacific Railway Company or its auxiliary companies, whether received through accident or carelessness on his own part or on the part of any other employe or person, or otherwise, this release being intended to embrace and include all claims for loss of service and for disability, pain or suffering, directly or indirectly, from any kind of injury or from death.

AND IT IS FURTHER UNDERSTOOD AND AGREED that the time or wages that may be due the said minor, shall be entered to his credit, and the said Union Pacific Railway Company is authorized to pay over to him or his order any amount due him, and his receipt or order shall be binding upon all the parties hereto.

IT IS FURTHER UNDERSTOOD AND AGREED that this agreement shall be binding if the minor is transferred to other duties in any department of the railway service, whether upon the Union Pacific proper, or any of its leased or operated lines.

Signatures .....

.....

.....

INSTRUCTIONS.

This release must be executed by the father (or legal guardian) and mother of the minor and by the minor himself, and transmitted as follows:

1. To the superintendent of motive power and machinery.

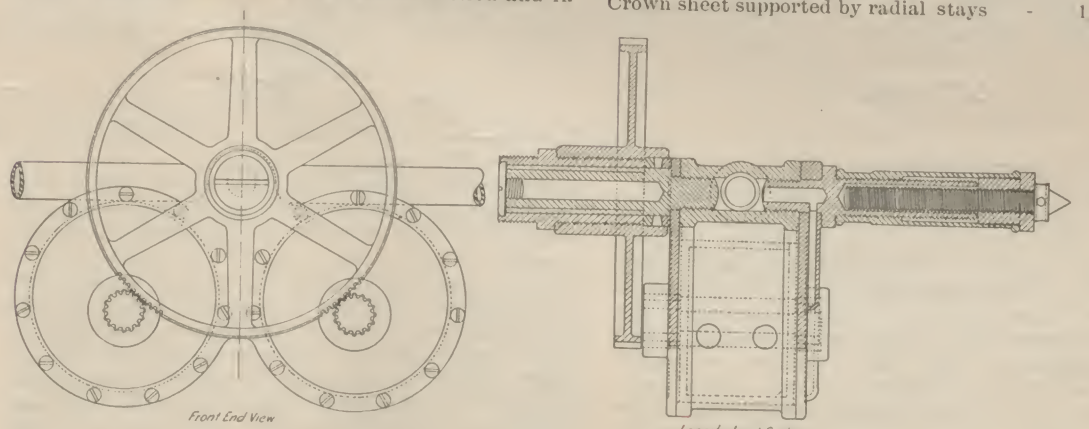
2. To the general attorney, for examination, final approval, and return to the office of superintendent motive power and machinery for record.

3. To the auditor, for final deposit, through office of vice president, as required by the rules of the company.

The results of the practical trial of electric traction on the Burlington & Mt. Holly branch of the Pennsylvania Railroad have been looked for with much interest by many, and is now stated that the comparative trials which were expected to show the difference in the cost of operating this line by electricity and by steam have been indefinitely postponed. It is also reported that while the electrical equipment is giving satisfaction, there is not business enough to require trains of sufficient frequency to obtain the full benefits of electric traction and that with the present intervals between trains the operating expenses are much greater than they would be where conditions favored the electric system. According to the Philadelphia Press there was much talk last year about converting the Camden & Atlantic line into an electric road, the matter having gone so far as to include estimates on the cost of operating that road between Camden and Atlantic City. It was found that if the present system of electricity was adopted that the cost of operating would be greater than if the road were operated by steam locomotives unless the trains were run at more frequent intervals. It was also found that if the trains were run every half hour the cost would be greater than it is now. This probably means a postponement of electric traction experiments on the Pennsylvania Railroad.

A NEW AIR MOTOR FOR SMALL TOOLS.

A new design for a light air motor used for drilling, tapping and similar work connected with locomotive repairs, is shown in the accompanying illustration, which was prepared from a drawing received from Mr. E. M. Herr, assistant superintendent of motive power of the Chicago & Northwestern Railway, the design having been worked out by Mr. Frank Slater, general foreman of the West Chicago shops of that road. The drawing shows three views of the machine, two of which are sectioned and in addition to this is a sectional view of the throttle valve which is applied to the motors which are used for drilling and tapping.



DOUBLE CYLINDER AIR MOTOR—C. & N. W. RY.

The design makes use of two rotary motors with the ordinary form of packing plates. Upon the axle of the motors small pinions are mounted at the outside of the cylinder heads which mesh with a large gear wheel mounted upon the main spindle of the machine, to which the tools are attached by means of a suitable chuck. The air supply is received through a pipe which is secured into the frame of the machine to which the cylinders are attached, this frame being cored out to conduct the air to the admission ports, the location of which is shown in the lower left hand view. In the construction of the pistons provision is made for the admission of the air pressure back of the slots in such a way as to cause them to be forced outwardly against the casings without the necessity of employing springs. The passages by which this object is secured are also to be seen in this figure. The exhaust ports, of which there are two for each cylinder, are shown in dotted lines in the lower left hand view, the right hand cylinder being in a position ready to exhaust from the upper side while the lower side has begun to take air from the supply. The pistons are set at right angles to each other so as to secure a uniform rotary effort so as to avoid the jerky motion produced by some forms of motors which are provided with single cylinders. In this illustration it would appear that the supply pipe is continued past the motor. This, however, is not the case, one of the pipes being used as a handle for convenience in operating the device.

A HEAVY COMPOUND BY THE PITTSBURGH LOCOMOTIVE WORKS.

The Pittsburgh Locomotive Works of Pittsburgh, Pa., has recently delivered a heavy compound freight locomotive of the consolidation type to the Lake Superior & Ishpeming Railway. The method of compounding is that supplied by those works, and employs two cylinders. An extended piston rod is used on the low pressure side. The front course of the boiler has a diameter of 64 in. and the diameter at the back head is 67 in. The cylinders are 20 and 31x28 in. The driving wheels are 56 in. in diameter outside of the tires, the total heating surface is 2198.1 sq. ft. and the grate area is 31.78 sq. ft., the fire-box being 9 ft. long and 42⅜ in. wide. The important dimensions are tabulated as follows:

Fuel	bituminous coal
Gage of track	4 ft. 8½ in
Total weight of engine in working order	147,600 lbs
Total weight on drivers	132,800 lbs
Driving wheel base of engine	15 ft. 6 in
Total wheel base of of engine	23 ft. 6 in
Total wheel base of engine and tender	52 ft. 10½ in
Hight from rail to top of stack	14 ft. 11¼ in
Cylinders, high pressure, diameter and stroke	20x28 in
Cylinders, low pressure, diameter and stroke	31x28 in
Slide valves	Richardson balance
Piston rods	steel, 3¾ in. diameter
Type of boiler	straight
Diam. of boiler at smallest ring	64 in
Diam. of boiler at back head	67 in
Crown sheet supported by radial stays	1⅛ in. dia
Stay bolts, 1 in. diameter spaced 4 in. from center to center	
Number of tubes	240
Diameter of tubes	2¼ in
Length of tubes over tube sheets	14 ft. 7 in
Length of fire-box, inside	108 in
Width of fire-box, inside	42⅜ in
Working pressure	180 lbs
Kind of grates	cast iron, rocking
Grate surface	31.78 sq. ft
Heating surface in tubes	2049.5 sq. ft
Heating surface in fire-box	148.6 sq. ft
Total heating surface	2198·1 sq. ft
Diameter of driving wheels outside of tire	56 in
Diameter and length of journals	8 x 9 in
Diameter of truck wheels	30 in
Diameter and length of journals	5 x 9 in
Type of tank	level top
Water capacity of tank	4000 U. S. gal
Fuel capacity of tank	280 cu. ft
Weight of tender with fuel and water	76,200 lbs
Type of brakes	Westinghouse American automatic

RAILROAD OFFICERS—AS OTHERS SEE US.*

W. G. BESLER, Supt. C., B. & Q. R. R.

A railroad company is a private corporation organized for the profit of its owners (at least it should be so). But the railroad, although in some sense private property and owned and operated by a private corporation, is yet regarded as a quasi-public highway, and an institution in which the public has an easement closely similar to that possessed in public highways. From the status of railroads as public highways it is assumed that railroad corporations, although in some respects private corporations are not altogether so, nor are they created solely for the pecuniary advancement or profit of the stockholders. Being possessed of extraordinary and unusual corporate powers, they also assume especial obligations involving great public interests. In this we have briefly the first view of the public toward the institution which we serve and which we represent.

Col. Haines in an address before the American Railway Association made the remark: "that to the public, the superintendent, the agent and passenger conductor represent the railway company." This statement we may assume to be almost absolutely correct, and I will base what little I shall have to say from this standpoint.

The agent and the conductor are but the creations of the superintendent and reflect his likeness or image, and we may dismiss them from further consideration and deal directly with the superintendent who, for the purpose of this paper, we will consider

*Read before the Central Railroad Association, Cincinnati, O.

s the officer to which it alludes.

At the head of the railway corporation the public sees a man more or less endowed with qualifications that fit him for the position he occupies. They see he must serve at least three great interests: 1st. duties to the owners; 2nd, duties to the patrons and public; and 3rd, duties to the employes.

As to the first: Faithfulness and zeal for the interests for those who employ us must naturally dictate a course that will bring to them reasonable gain and profit from the enterprise in which they have embarked. In this we must not lose sight of the fact that although we are the agent of a private corporation and the chief end of our efforts are for the benefit of the owners, yet our supervision is exercised over a quasi-public highway, and we are in a manner a quasi-public servant and zeal for our employers must not lead to a disregard of their best interests by a neglect of the second and third duties named.

Next, as to our duties to the public—A great railroad magnate once said: "the public be ——." No sentence or remark ever made before or since has been caught up as were those four words, and it seems to me their echo or reverberation has been coming back ever since from the public—but with the word "railroads" substituted. Fame and fortune await that man who will propound a remark which will likewise, as a by-word, be caught up—but which shall be diametrically opposed in its meaning to this famous sentence. Way back long ago, we used to sing at Sunday School something about "kind words will never die." We may safely assert that the other variety is possessed of equal if not greater longevity.

No man is a hero to his valet, and we do not expect much laudation at the hands of our brother officers. But did it ever occur to you how absolutely little we know about operating a railroad when it comes to a discussion by the traveling fraternity? Has it ever occurred to this Central Association of Railroad Officers to ask permission to send a delegation to a convention of commercial travelers? The American Railway Association some time ago sent a delegation to London to attend the International Railway Congress. That is just where they made their mistake, and that delegation should have attended the recent convention of the Travelers' Protective Association at Terre Haute, to have learned the best methods and practice for railroad management.

You have all heard the statement that nothing is easier than to manage a railroad or a hotel, as all that is required is for you to furnish the property and the public will tell you how to run it. Yet I do not believe we should object to some of these criticisms. We are told that it was asses who by gnawing the vines, first taught man the advantage of pruning them, and the moral and thought conveyed by this truth may find a wide application with us.

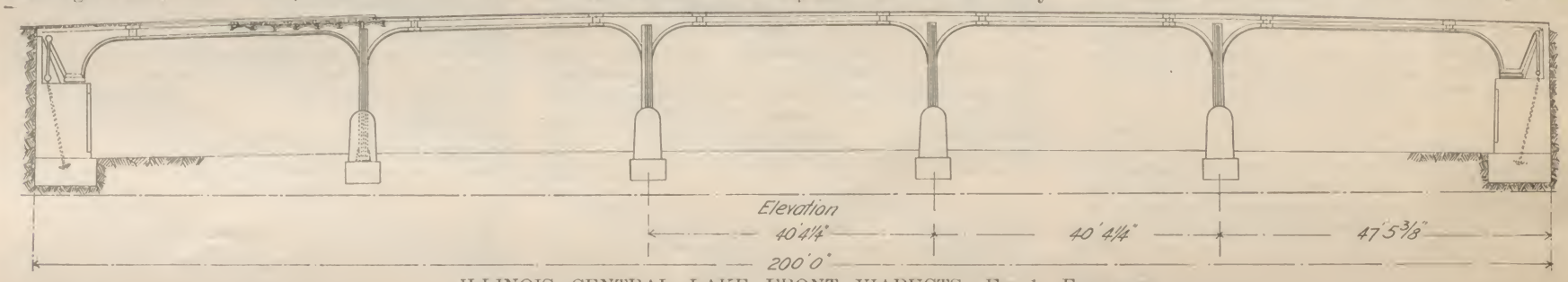
A criticism most common and often warranted is that of "Big Head." Many officers have risen from lowly stations to their exalted positions by dint of hard work, perseverance, energy and cheek, and they believe that they have something extraordinary in their composition and person which renders them above ordinary criticism and the object of much admiration. Too often the private citizen, no matter how important his business, finds much difficulty in obtaining an audience, and, if at length admitted, is cut offshort and no effort made to satisfy. Again there is unnecessary red tape, and the referring from one officer to another, and one department to another—instances of which you have all seen—especially in the handling of claims. It is true that the railroad officer is a busy man—but it is the busy man who will always find time to do a thing. If a thing is worth doing at all, it is worth doing well, and in dealing with our patrons we should endeavor to apply this and answer a civil question in a civil manner.

It has been stated that the action of the railroad officers colors the action of most of the employes; and that one who is familiar with the manner of the officers toward the customers will find the same policy and manner of address prorogated through all the ranks. If this be true, then how important it is that we give the color the right shade, and one which is acceptable and pleasing to the public eye.

Now a word as to politics. The wise officer should know no man's politics and should keep his railroad as far as possible aloof from all partisan influences: prejudice and partiality have no place in the conduct of this business, and to mix up and interfere in such matters cannot but in the end cause trouble. We should remember that the primary is the pivot on which political issues are turned and rather with your force and organization stand as a menace of what you may accomplish and which is understood and respected fully, then go into each issue and disclose your strength or lack of it and encounter the well known adage "of familiarity breeding contempt," I presume most of my hearers have read of the baneful effects brought about in New Zealand and Australia by mixing politics and railroading.

There is an excellent Japanese maxim which says, "Dig the well before you are thirsty." The moral of which is directly applicable in our dealings with he public and their regard toward us.

The railroad company is a resident, a tax payer, and we may say a voter in every community, and yet it is as a man without a country. It is not known, or at least favorably known, there. A special train dashes through a town; a private car is attached to the rear of the regular train: the inhabitants presume that it is the superintendent, or some high official, and a few curious faces peer in at the observation windows and you can see whispered advice passed around that "it's so and so." This often covers the extent of acquaintainceship between the community and the company. A well known judge said: "The trouble is, you railroad people do not get out among your local patrons and residents, they don't know you and are against you without reason except that they don't feel any friendly or neighborly feeling toward you." He said "there are gatherings at local stations along the line, social doings and celebrations, at which old men who had lived there all their lives have told me there never was a railroad officer in their village whom they had met. "Can it be wondered in view of facts in this light that railroad companies cannot get favorable verdicts from juries composed of these citizens. It seems to me that we can all well afford to give this matter our serious consideration. True, we have not the time to spend at local celebrations every day in the week, but if but one day a month should be so taken we would in time get around, and we could to advantage do at least that much and perhaps a little more if it will serve to create a sentiment along the line favorable to the company whose interests we have at heart, and for whose welfare we are willing to work day and night. A more intimate knowledge of the wants and wishes of the patrons will come from a better acquaintance with them; as they prosper and succeed so will your company which serves them, prosper. Treat them liberally, do all in your power to encourage morality in business, but do not allow them to dictate your policy; special favors should be few, strict justice and a rigid fulfilment of all contracts should be an absolute practice. If a railroad officer does not comprehend a situation so much the worse for him and all concerned. Any lesson he may learn may come too late to be of any avail. From the foregoing it would appear that our duty to the public may be simmered down and largely covered by the expression "try to live neighborly with your neighbors".



ILLINOIS CENTRAL LAKE FRONT VIADUCTS.—FIG. 1.—ELEVATION.

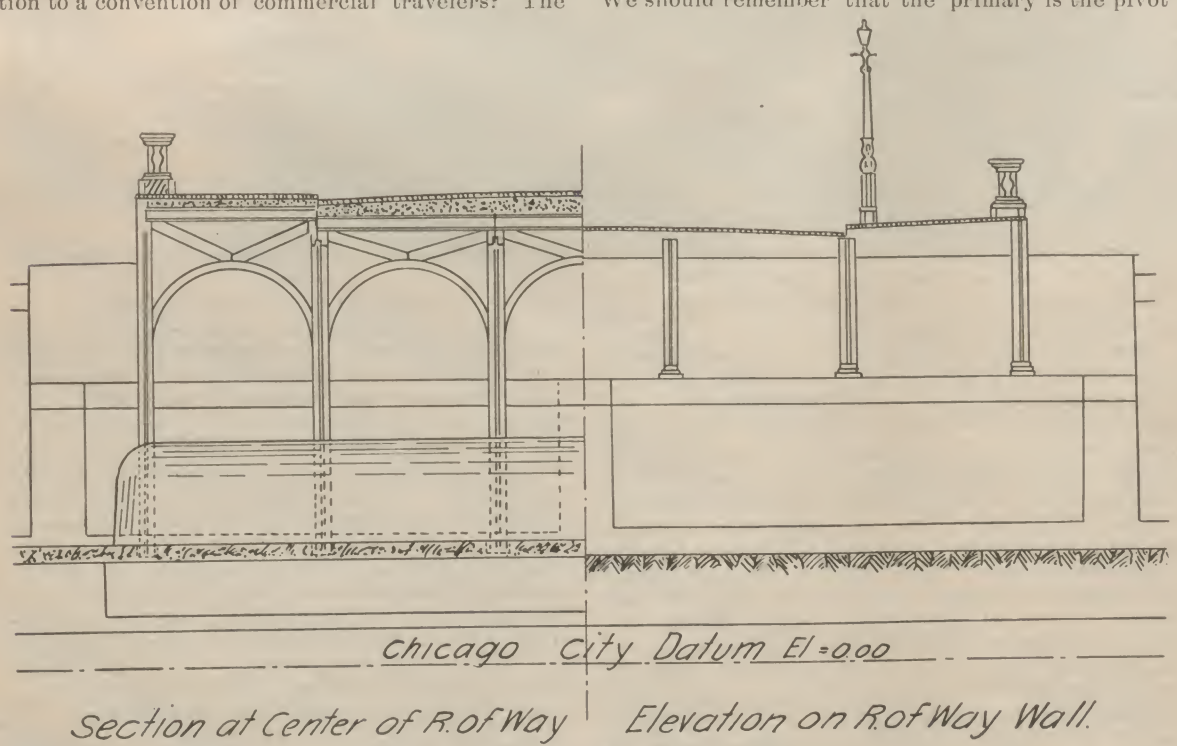


FIG. 2.—SECTION AND ELEVATION.

Now a few words as to our duty to employes.—The managing officer is placed over a multitude of subordinate employes, and it is his duty not only to utilize their energies to the best advantage of the company but also to study their characteristics and needs in order that he may intelligently devise methods to increase their efficiency, thereby indirectly increasing their pay and wise measures to promote their comfort and happiness.

Did you ever stop to consider how you appear to your men? Are you hated and feared or respected and loved? Have you their confidence? Are you their superintendent in fact as well as in name? Have you ever thought of the little homes and firesides in which your name is mentioned and your various acts are discussed? Have you ever thought of the joy and pleasure some little act or word you have spoken, some good advice you have given, some little consideration you have shown, has produced in those homes, and of which you have not even given a second thought.

It has been stated that a man is a man and whatsoever more he is, is what he makes himself, and that the successful manager of the future will be the one who can do for his men what he has been able to do for himself. Some of the most successful discipline applied has been by turning the tables and asking the man to imagine he was sitting in your place and saw himself from your standpoint in view of the misdemeanor he had committed. We have a duty that we must perform, and a discipline that must be enforced, but to see ourselves as others see us who may with clearer eyes discern what we cannot, might often, should we stop to consider, alter our course and change our action in a

manner that future time would make us profoundly grateful.

In conclusion, it is plain that the managing officer occupies a position requiring patience, tact and skill: he has to meet and deal with all classes of persons, whose personal interests are often antagonistic. The stockholders who want and should have dividends: the public who clamor for lower rates, and the employes who demand higher wages. Does the man exist who can reconcile these conflicting interests and solve the various problems confronting him to the satisfaction of all concerned? If there be one he certainly has not been heard from lately and his present whereabouts are unknown.

One of the earliest recollections of my school-boy days is a rhyme in one of the old readers, something to the effect that "A man of words and not of deeds, is like a garden full of weeds." At that time I did not understand what it meant. I knew what a garden full of weeds meant, and it was something that gave me a pain and I did not allow myself to think about it much longer than necessary. But, in later years with a clearer understanding of that maxim I have though better of it and believe it covers ground that we, as superintendents, can well afford to consider. More earnestness, more thoroughness, more consideration, greater care and painstaking, and lastly that golden rule, do unto others as you would they should do unto you. This done, we may indeed be able to stand the test of railroad officers as others see us.

VIADUCTS OVER ILLINOIS CENTRAL RAILROAD—CHICAGO LAKE FRONT IMPROVEMENTS.

Under an ordinance for the improvement of the lake front in Chicago passed by the city council in October, 1895, provision was made for the construction of four viaducts across the tracks of the Illinois Central Railroad in connection with the Lake Front Park and the depression of the tracks which was described in a general way in the RAILWAY REVIEW of November 23, 1895. These viaducts are to be constructed at Monroe, Van Buren and Harrison Streets and Peck Court. The first mentioned structure will not be built at present but the others are now under contract and the abutments are being erected. These viaducts will be made in five spans with posts for support between the tracks, the ends of the structures being supported by abutments built in the retaining walls along the east and west right-of-way lines. The viaduct at Van Buren Street will have a roadway 60 ft. wide by 260 ft. long including the work over the suburban station which will be located under its west end. Each of the other viaducts will be 50 ft. in width by 214 ft. long. The total floor surface of all the viaducts is to be about 37,000 sq. ft. All will be constructed in uniform style with five equal spans of 40 ft. 4¼ in. Each bridge will be constructed upon parallel girders with arched supports at the columns. The supports will form short cantilevers and the sections between their ends will be in shear and formed of girders placed 9, 10 and 12 ft. apart, connected by 10 in. I-beams spaced at 3 ft. 1 ¼ in. centers. The floors will consist of an asphalt wearing surface laid on a concrete foundation, the concrete being supported by tile arches placed between the I-beams.

The ordinance referred to provides for a higher elevation of the tracks in the center of the right-of-way from those upon the east and west sides and to conform to this requirement, the top surfaces of the girders for each viaduct will be built to a curved line having a versed sine of 2 ft. in the center of 200 ft. in length, or to a radius of 2,500 ft. The girders are to be 2 ft. deep over the angle and the sections of the floor which go between the cantilever supports will conform to the above mentioned curve. Each line of the parallel girders will therefore consist of five spans and each span will be divided into three parts, the central part will be slightly curved and 2 ft. in depth with top and bottom flanges made of angles and two arch connections to the adjacent posts. Anchorages are provided at the abutments to prevent extreme deflection of the adjacent girders. Expansion is provided at both ends of the structure and none at the intermediate posts which are expected to deflect sufficiently to give the structure any necessary movement from expansion and contraction. The girders under the section forming the roadway and the outer girders under the sidewalks will be uniform. The two girders at the junction of the roadway and sidewalk will have a different construction for the top flange in order to give the requisite elevation to the sidewalk. The connections for the I-beams or floor joists will be of the usual pattern except at the edge of the sidewalk adjacent to the roadway. Tie rods will be put in between these floor beams to prevent any deformation while the tile and concrete work is under construction.

The steel superstructure at Van Buren street is estimated to weigh 240 tons. The other viaducts will each weigh about 190 tons. The specifications for steel require two classes, namely, medium and soft steel, both of which are to be made by the open hearth process. There is nothing unusual in the requirements of the steel, which place the ultimate strength between 66,000 and 58,000 lbs. for medium steel and between 58,000 and 50,000 lbs. for soft steel, the minimum elongation being 20 per cent and the minimum reduction of area 44 per cent for medium; and 28 and 50 per cent for soft steel. The work is that usually specified as "punched", in which no reaming is called for except when necessary in fitting up. All surfaces riveted in the shop are required to be scraped and painted before putting together. In laying out the holes for the curved sections, allowances are made for strains due to a dead load of 6,000 lbs. per square inch, sufficient additional camber being required to compensate for this loading, the intention being that the line of the curve shall be perfect under the dead load of the structure. The expansion arrangements are not unusual in construction and employ rollers. A coat of raw linseed oil is required before shipment and the surfaces are required to be cleaned of rust and mill scale before this is put on. After erection all work is to receive two coats of black bridge paint. In the erection no falsework will be permitted between the tracks and after the abutments are ready the posts supporting the girders are to be placed in position first. These will be connected by the transverse bracing, after which the connecting sections of girders are to be put in place with a sufficient number of floor joists to stiffen the whole structure. The contractors for the steel superstructure are the American Bridge Works of Chicago.

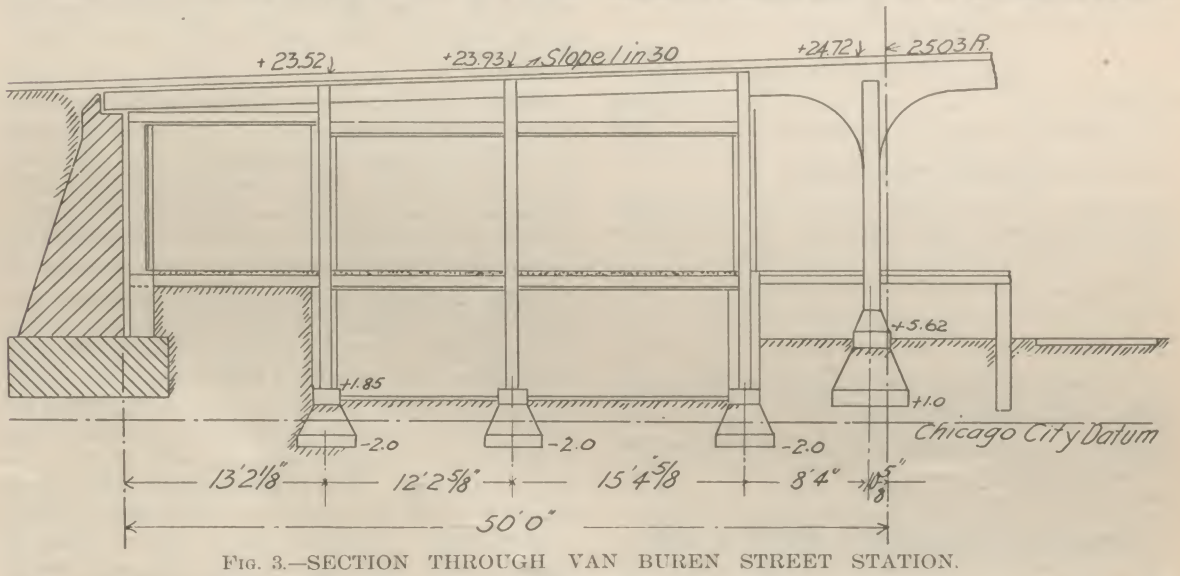


FIG. 3.—SECTION THROUGH VAN BUREN STREET STATION.

Between the I-beams, constituting the floor joists, arches will be built supporting the concrete floor with its asphalt bearing surface. These arches will be of hollow salt glazed tiling of a minimum thickness of ¾ in. They will be of 3 ft. radius on the under side, the depth of the tiling being 6 in. The chief object of this tiling is for the protection of the steel work against corrosion by the gases from the locomotive stacks, and all joints are required to be filled with mortar. The bottoms of the I-beams will be protected by tiling keyed between the skewbacks of the arches, the I-beams being tied between each pair of girders by the rods which will be covered by the tile construction. The outer faces of the outside girders will be covered with ornamental terra cotta, which will be locked in position by the form of the pieces and also by the usual ties to the structural iron work. The outside posts will also be covered with the same material. It is not yet definitely decided as to the covering of the intermediate posts. They may be covered with plain tiling.

The concrete and asphalt work for flooring the viaducts is to be put in according to specifications from which the following notes are taken. The concrete shall be composed of one part of Portland cement to two and one-half parts of sand and six parts of unscreened limestone, the largest pieces of which are to pass a two and one-half inch ring. The concrete is to be filled in above the tile work and between the floor joists of the viaduct, being well rammed in place so as to force the finer material down into the angles between the tile arches and floor joists. The top surface of the concrete when finished is to be parallel with the wearing surface. The asphalt forming the wearing surface is to be composed of two courses, a binder course of 1 in. thick is laid upon the concrete. This course is of crushed limestone which is required to pass a ¾ in. ring, and asphaltic cement in proportions of 15 gals. of asphalt to 1 cubic yard of stone. It is to be spread at a temperature of 100 deg. Fahr. and to be rolled with a five ton stone roller to a final thickness of 1 inch. The asphaltic cement is to be made from asphaltum from Pitch Lake, Island of Trinidad. The wearing surface is to be composed of from 10 to 15 per cent of asphaltic cement, and 70 to 83 per cent of sand, to which 5 to 15 per cent of pulverized carbonate of lime is to be added. The sand and asphaltic cement are to be heated separately to 300 deg. Fahr., the pulverized carbonate of lime to be mixed while cold with the hot sand and then mixed with the asphaltic cement. This is to be spread at a temperature of 275 deg. Fahr. and rolled. Before the rolling a small amount of hydraulic cement is to be swept over the surface. A five years' guarantee is required against defects except those due to extraordinary wear.

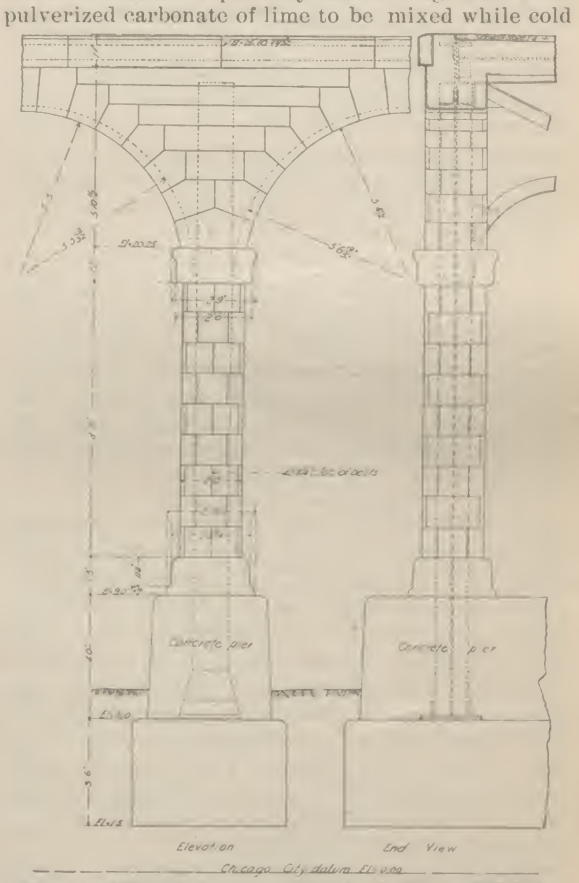


FIG. 4.—DETAILS OF TERRA COTTA WORK.

We are indebted to Mr. J. F. Wallace, chief engineer, and Mr. H. W. Parkhurst, engineer of bridges of the Illinois Central Railroad, for the drawings and information presented here.

Assertion vs. Fact.

Assertion—"The farmer and laboring man are poor and we want to introduce free coinage of silver so that they may have more dollars."

Fact—The farmer or laboring man can today get as many dollars as he can (1) earn, or (2) give goods for, or (3) give good security for borrowing. There are probably 200,000,000 unused dollars now in the country. If there were ten times as many there would be no other way in which the farmer or laboring man could get hold of any part of them than those above mentioned.

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CHICAGO, SATURDAY, SEPT. 5, 1896.

PRICES are steady but sales are trifling in the iron trade. The billet combination decided a week ago to maintain its grip on prices and production, Fall orders do not multiply for any kind of material. In pig iron large transactions are promised in a few days by consumers who apprehend firmer prices as a result of reduced supply of the possible presentation this month, of fall and winter requirements. Consumers are somewhat apprehensive of a sudden covering of winter requirements due to the more settled public sentiment. This might not lead to an advance in prices but it would lead to a withdrawal of some quotations recently made to produce instant cash. Rails and all railway equipments are quiet and dull, structural steel will probably lead off when the improvement dawns. The smaller shops, factories and foundries are not crowded. Car wheel, car axle, and equipment works are running slack and managers are far more concerned with the maintenance of credit and corporate existence, than with new work. The strain is intense.

THE presidential address of Professor Mansfield Merriman before the Society for the Promotion of Engineering Education which will appear in abstract in our issue of next week contains a number of valuable ideas in connection with the courses of instruction which are given in engineering schools of this country. It is interesting to know that this authority corroborates the statement made in these columns last week with regard to the character of engineering instruction. Professor Merriman believes that instruction should stop short of giving mere information without engineering training. His position upon this point is expressed in the following words:

> In all courses in construction and design the practical limit seems to be reached when the exercises are of such a nature as to give mere information and little scientific training. The aim of all education and of engineering education in particular should be to render the student conscious of his mental power and sure of applying it with scientific accuracy so as to secure economy of construction. Fundamental principles are hence more important than the details of a trade and all exercises in design should be arranged so that the student may think for himself rather than blindly copy the best practice of the best engineers.

A VERY interesting contribution to the subject of the effect of repeated shocks upon cast iron was made by Mr. A. E. Outerbridge, chemist to Wm. Sellers & Company of Philadelphia, in a paper read before and the American Institute of Mining Engineers, which was published in abstract in the RAILWAY REVIEW of April 11 of the current volume. This paper will be remembered to bring out the fact that shocks upon cast iron such as are administered by treatment of castings in a tumbling barrel, have the effect of equalizing the shrinkage stresses which practically amounts to annealing the casting. While the statements of this author have not been adversely criticised publicly, they have awakened considerable interest and also have brought out some adverse criticism which has not found its way into print. Those who have not accepted the statements of this experimenter will doubtless be interested to know that a number of manufacturers have repeated these experiments and have obtained in some cases greater gains in strength of material than those recorded in the paper. This fact should establish beyond a doubt in any fair mind that the principle which may be said to have been discovered by Mr. Outerbridge is correct.

IT IS now some time since a serious railway accident in this country has been laid to the failure of continuous air brakes to perform properly the work for which they were designed. Yet excuses of failures may be confidently expected to appear in evidence in investigations of accidents which may occur, whether due directly to faults of the brakes or not. In other words it is convenient excuse in case of reckless running to say something was wrong with the air brakes. As a rule such testimony cannot be refuted for the reason that in a collision the controling apparatus of the brake equipment is likely to suffer derangement to such an extent as to prevent the apparatus itself from giving evidence as to its condition at the time of the accident. Nearly all roads in this country, and it may also be said that this applies to every road in Great Britain, using continuous brakes, have a clause in force in the rules governing their use which requires them to be tested before starting out from a station. This custom is followed out very carefully and without doubt contributes largely to the freedom from accidents due to inoperative brakes, but in a recent conversation with a number of mechanical officers upon this subject a plan of testing brakes was spoken of by Mr. J. H. McConnell, superintendent of motive power of the Union Pacifi. Railway, which has been used upon that line for several years with the result of entirely doing away up to this time with all reports of air brake failures on the road while trains were running. The air brakes are tried as usual while the trains are standing at the terminal stations and the car inspectors examine the brakes upon each car after giving the engine runner a signal to apply them. This, however, is not considered sufficient, and after the train has pulled out from the station and while the locomotive is working steam the brakes are again put on in service application so as to reduce the speed almost down to a stop, when if everything is found to be satisfactory the brakes are released and the train proceeds This is carried out at every passenger termiminal point and at every intermediate stop after cars have been taken on or set out from the train. Very little time is lost in doing this and the advantage consists in absolute knowledge by the engine runner that the brakes are all right after the train has started. There is a requirement in the rules of the Great Northern Railway of England providing for testing the brakes by actual use once in every twenty miles traversed and an application is also required at the distant signal of every important station. This seems entirely unnecessary and conformity to such rules would cause delays from which no proportionate advantage in safety is to be gained. But the rule which is enforced upon the Union Pacific Railway would seem to give the necessary assurance with practically no delay, and this practice is one which might well be imitated.

IT IS a well known fact that during the last few years great progress has been made in the increased production of machinery by special tools and methods until it has become practically impossible for the use of methods and equipment of say ten years ago, to compete with the newly developed shop machinery. Mr. H. L. Arnold, writing in the Engineering Magazine, begins a paper on modern machine shop economics with a warning to engineers and superintendents against trusting their own knowledge or past experience in the use of tools as a guide in making extensive purchases of new plant without first correcting their own conclusions by a careful and extended observation of recent installments in similar lines. Perhaps such a warning to these men is unnecessary as far as purchasing new machinery is concerned. Perhaps every man in responsible charge of constructive or repair work in either contract or railway shops is fully aware of this progress, and yet it is easy to find antiquated machines running in the same old way because some one does not appreciate the movement of the world. Each new industry brings to the light some new process or improvement upon old ones, and we have to thank the manufacture of bicycles for showing that an enormous increase may be made in the speed of drilling by increasing the speed of the tool. The effective production of drills has been doubled in this industry until a feed of one inch per minute with a drill one and fifteen-sixteenths of an inch in diameter has been attained, and that in steel forgings. This has been accomplished by decreasing the feed per revolution and greatly increasing the rotative speed. It is highly probable that Mr. Arnold's warning ought to be extended in scope to apply to shops which are not being refitted with new tools, but which are now in operation with machines which are not producing all of the work which they might be made to turn out. It is evident from a comparison of the capacity reached by bicycle manufacturers that many drilling machines are not doing nearly the amount of work to which they might be pushed. That there is a great difference in shops in this respect is proven by the fact that the drilling speeds used, for instance in the establishment of Messrs. Brown & Sharpe, are over twice those which are given by the manufacturers of twist drills, as the proper speeds for these tools to be operated. This concern uses the speeds which it has found to be the most economical, all things considered, and there are other firms which have more than doubled the output of drill presses. For instance, one case is known in which the time required for drilling a given hole has been reduced to one minute from the former practice which required seven minutes. If the increase of speed were to be accompanied by rougher work this would not be all clear gain, but the decrease of the rate of feed and the increase of speed are the means of improving the work.

FREE COINAGE AND THE WAGE EARNERS.

The effect of the maintenance of the gold standard upon the wages of labor, seems to be a point generally dodged by the advocates of the free coinage of silver. Labor is the largest commodity. If gold has risen in price as is claimed, then labor must necessarily be receiving less pay in gold or its legal equivalent than it did before the rise. Grain, iron, transportation, silver bullion, and other commodities have certainly changed their relation to gold. They all bring much less now in gold than they did when the actual market value of silver was one-sixteenth that of gold weight for weight.

How is it with labor? If wages have actually declined like other commodities, then it might be claimed with some reason that the real truth was that gold had appreciated.

The date ascribed as the beginning of the rise of gold is 1873, when it is claimed (falsely) that silver was demonetised. Since that time, however, it is a fact that wages have been higher than ever before. Labor, skilled and unskilled has received a higher price in gold, than it ever did prior to that date. The real condition has been that wages have gained while other commodities have fallen off in price. The condition of the wage earner has therefore improved under the present monetary system of the United States. The average rise in wages since 1873 has been more than one-third—and payment has been made in gold; or money maintained at a parity with gold by the government.

Does any intelligent wage earner believe that when the silver dollar reaches its true level of 51 or 52 cents, under free coinage, he will receive twice as many of them for his day's work as he now does? The object of the free silver agitation is, the claim, to raise prices. The producers of grain silver, etc., have got ahead of the demand; and the result has been lower prices. It is now proposed to bolster up those prices by legislation. If face coinage is adopted the wage earner will be the one to pay the difference—the real sufferer.

Tables showing the wages paid for labor in free silver countries, and the purchasing power of the money, have been extensively published. They tell the story in a very graphic manner. In Mexico the average daily wages of twenty-one classes of workers is $1.85 cents in Mexican silver; or 93 cents in gold. The average pay of the same classes in the United States is $2.33 in gold, or its equivalent. The average in Mexico of twelve of the leading necessaries of life (such as flour, meat, tea, etc.,) is 34½ cents a pound in Mexican money or 17⅛ cents in gold. The average price of the same products in the United States is 11½ cents a pound.

The Mexican worker therefore receives less than one-half the wages of the American and pays for what he consumes over 50 per cent more. This is the legitimate effect of free coinage of silver without limit. Will the workers vote for this change?

APPRENTICESHIP.

I.

There is probably no more difficult or important problem connected with the railway shop management, and this applies also to manufacturing establments, than that of providing satisfactory workmen. The trouble seems likely to increase unless the proper steps are taken to keep up the supply, and there is no need of apologizing for again calling attention to this important subject. Ever since the presentation of the report entitled "The Apprentice Boy" before the Master Mechanics' Association in June, efforts have been made to ascertain what the practices were on different roads with reference to apprenticeship systems. The receipt of the rules governing the admission and training of apprentices on the Union Pacific Railway, which are reproduced in full elsewhere in this issue, resulted from this inquiry, and they are presented in the hope that knowledge of the success which has been attained with them may prove valuable to others. It is possible that many roads have systemmatic plans governing this department, but the experience of ten years renders these rules of special interest in view of the fact that Mr. McConnell, superintendent of motive power of this road, is reaping the benefit of the plan and deas not seem to be having the difficulty experienced by others in securing good men. This system has been in use through several different administrations of motive power officers absolutely without change, which testifies to the forethought and care employed in the compilation.

It is a very comman thing to find apprentices working in railway shops and it is evident that there is an increasing tendency to treat this matter with the consideration which it deserves. Unusual interest was shown at the recent conventions by many of the members, which is a hopeful sign promising improvement. The committee of the Master Mechanics' Association already referred to placed comparatively little weight upon the shop training of apprentices, evidently considering what may be termed academic instruction as of greater importance. This committee thought it useless to recommend an apprentice system to the association, and it is believed that their work might have been of infinitely greater value had they given their entire attention to shop training and left the school side of the question to be taken up later. By this no slight is intended to the important matter of instructing boys in the lines suggested by the committee. It is believed that this work might be satisfactorily and ap propriately carried out by the technical schools with, of course, the co-operation of the mechanical officers of the roads. The railways should interest themselves and advance in every possible way all means by which shop employes, whether boys or men, may be instructed and elevated intellectually above the ruts into which they are likely to fall by the routine of their daily employment, but not to the neglect of the best instruction in shop work.

Before considering the system in use on the Union Pacific, it seems desirable to look over the work of organization which has been perfected on European railways, and is exceedingly complete. The French railway school workshops which have been specially arranged for the instruction and training of apprentices are interesting, and while the methods found desirable there are very different from what we require in this country, there seems to be much in the application in France which should be understood before attempting to establish plans intended to accomplish the same results here. The essential difference in conditions in the two countries, France and the United States, lies in the great facility with which boys may acquire a satisfactory general education from our public schools, whereas, in France, boys of the grade of society seeking apprenticeship must rely more on their employers for what education they receive, beyond perhaps of that of the most elementary schools. The education of apprentices divides itself naturally into two parts, the purely technical instruction, and the shop or manual training. It is more necessary in France to make the first mentioned part of the education the more prominent and it is, therefore, to be expected that shop technical schools will be found there under a high degree of development. To apply the same method here would be departing decidedly from the province of railways.

French apprentices are usually given education in theory and practice under the same authority and generally the first part of the day is devoted to studies and the latter part to shop practice. The boys are paid small wages, increasing according to their value: the shop training, however, under this method requires an extensive plant which cannot be used for any other purpose, and while there is no question as to the desirability of such methods, their expense will prevent consideration in this country. The pay ranges from three to nine and one-half cents per hour in France and as much of the time is put in under the lower rates, the roads must profit considerably from the actual work of the boys; but no profit is sought from the system as the money gained is immediately put into the school expenses, leaving the training of workmen as the sole object. At a number of French shops the boys enter upon apprenticeship at about thirteen years of age after having a merely rudimentary education and from the first the time is equally divided between study and work, the time spent in the school being counted as a part of the term of apprenticeship. In a number of cases prizes are offered to encourage emulation and the wages are paid in the form of a bank book with an account to the credit of the apprentice. Among the studies drawing is made prominent, including descriptive geometry and freehand sketching from models as well as machine drawing.

To obtain an idea of the development of this system it is of interest to note that there are two hundred and thirty-eight apprentices now employed in the works of the Eastern Railway of France and that the present arrangement is the result of a growth of fifteen years. The sons of workmen are given preference, and from the first wages are paid beginning at twenty cents a day at Paris and ten cents a day in other shops, and if the services are satisfactory the boys are eligible, every five months, to increases of five cents per day. On this road after some idea of machine work has been gained, the apprentices are placed under regular instructors in the different shops who are selected with reference to their ability to do good work as well as to teach how it should be done. The term of apprenticeship is four years, lasting from October to the following August, with an interval of the month of September. The studies accompany the shop work appear to be the equivalent of the ordinary grammar school education of this country with the addition of geometry, mechanics and drawing. In the locomotive shops the instruction begins with the use of the hammer, chisel and file, and the making of small parts of locomotives and simple tools. In the second year boiler making, fitting and erecting, are taken up, and part of the third year is devoted to blacksmithing. This is an example wherein the manual instruction is carried on in connection with the regular shops.

An example of the special shops and school is that of the Northern Railway Company, which has a school equipment for working metal and wood. In the machine shop are twenty-two lathes, forty vices, nine forges, and several special machines. This requires eighteen instructors, who are selected from the shop force and who devote their entire attention to the apprentices, of whom there are about fifty. No indentures are signed and the apprentices may withdraw at any time if their parents or guardians desire. The pay ranges from twenty to forty-five cents per day, which in certain cases is increased by allowing some of them to do piece work.

The special shop and the shop school are both out of the question here, but a corner of a shop may profitably be devoted to apprentices who may work under the direction and instruction of a man selected carefully with special reference to his fitness for the position. This instruction should not be slighted, but should be followed closely by the officers, as it is very important, and the foundation of a successful system.

Comment upon the Union Pacific code will be reserved for next week.

DERAILMENT OF TENDERS ON CURVES BY PASSENGER CARS.

A number of cases of the derailment of the rear trucks of locomotive tenders when coupled to trains, both in making switching movements in the yards and in running over sharp curves on the road, have attracted the attention of several superintendents of motive power to the fact that something must be wrong to make such accidents possible, and yet comparatively little has been done to ascertain the cause of this difficulty. A short time ago two cases of this kind occurred in the yards of the Chicago & Northwestern Railway and the matter was brought up for investigation. This road is not by any means alone in regard to such occurrences and upon inquiring a little into the question as to what other roads have done upon which trouble of this kind has been experienced, it is found to be not uncommon for the tenders to be coupled to the train by means of a link and pin which was done to avoid the difficulty. Derailments of tenders are much more frequent where automatic couplers of the M. C. B. type are used and in certain cases the tender trucks appear to have been pushed sideways until the flanges mounted the rails and all four wheels of the rear truck were derailed.

The Northwestern mechanical officers experimented with a passenger locomotive and a car both of which were fitted with automatic M. C. B. couplers, and as the long overhang of passenger cars, that is the comparatively long distance between the center of the truck and the face of the coupler, was believed to have an influence on in the derailments, a car with an overhang of 11 ft. was selected. This car was placed upon a 16 degree curve and when the tender of the locomotive was backed up so that the couplers nearly touched, it was found that the center of the coupler upon the car was 11 in. to one side of the center of the tender coupler which accounted at once for the derailment of tenders upon curves. An overhang of 11 ft. is not unusual for cars with six wheeled trucks and frequently cars are found with as much as 12 ft. overhang. This causes considera'ble lateral movement of the coupler in passing curves and if sufficient play is allowed no trouble is experienced. There seems to be no difficulty when cars of about the same overhang are coupled together, but when a car with a long overhang is coupled to a tender with a short overhang considerable clearance is necessary. The tender coupler will tend to keep nearer to the center line of the rails on account of the short overhang and also because of the small lateral motion which is possible with rigid trucks which are usually applied to tenders. In investigating the subject a diagram of a slip switch was constructed and it was found that in passing over the reverse curve a lateral movement of as high as 15 in. from a point over the center line of the rails was made, the curvature being about 16 deg. This merely indicated the amount of motion which must be provided for.

The next question was as to what the effect of this lateral motion would be in causing a tendency for the tender trucks to leave the rails, and it was determined to ascertain as nearly as possible the amount of pressure occasioned by this lateral movement. For this purpose a car 62 ft. long over the body and 71 ft. 1 in. over the draft timbers was selected, having 47 ft. 4 in. between the centers of the trucks. This was the same car that was used for the displacement tests with an overhang of 11 ft. In the carry iron a space of 1½ in. was left at each side of the coupler shank in the construction of the car, and in order to put this car into what was considered the condition usually found in passenger equipment to which automatic couplers have been attached, wooden blocks of 1 in. in thickness were placed in the carry iron at each side of the coupler shank, leaving but ½ in. play on each side. The tender

coupler also had ½ in. play on each side, and when this car was backed around a 16 deg. curve by a locomotive the oak blocks were crushed to a considerable extent. From this the idea was conceived of measuring the thrust in the carry iron by means of the crushing effect, and lead blocks were cast 1 in. in thickness of proper shape to fit in the carry iron at each side of the coupler. Three of these blocks were cast from the same pattern, and two of them were placed in position beside the coupler. The car was then run around the curve and the crushing of the lead took place as before with the wooden blocks, the depth being about ⅛ in. In order to ascertain the pressure which was required to indent the lead to this extent, the third block was fitted up in a testing machine at the laboratory at West Chicago in such a manner as to make it possible to apply pressure under conditions similar to those which obtained with the other blocks. It was found that a load of 57,600 lbs. was required to obtain the same indentation in the lead, which would indicate that the pressure produced by passing such equipment around curves is enormous, and in the case under consideration the pressure was apparent in the grinding of the flanges of the wheels against the rails and in the pressure on the boxes.

The next question was how to avoid these pressures, and this is important in view of the application of M. C. B couplers to passenger equipment. It was found that upon this road no change was necessary in the cars, because they have had an allowance of 1½ in. clearance upon each side of the coupler since 1892, Mr. Schroyer having as early as that date anticipated the difficulties from a long overhang. In the tenders, however, it was necessary to make an additional allowance of 1½ in. on each side of the coupler, or giving it a total lateral clearance of 4 in. When a tender with this play and a car with 1½ in. clearances on each side of the coupler were coupled together, it was found that the curves could be passed over readily, and further than this, that the automatic couplers could be coupled when standing on such a curve, sufficient clearance being provided in the boxes, the swing motion truck of the car, the clearance of the wheel flanges against the rails and the looseness of the couplers in the carry irons to provide all of the motion required. Of course the gage of the track would have much to do with the trouble of derailment from a lack of proper clearance, but the investigation showed that with ordinary conditions, certainly a dangerous combination exists, from which derailment of tenders may be expected. They are more likely to occur with lightly loaded tenders which have wheels which are not badly worn, and with such pressures developed as are indicated by these tests, it would seem that the tendency to overturn the rail would be great in the case of a worn wheel with sharp flanges. We are indebted to Mr. C. A. Schroyer, superintendent of the car department of the C. & N. W. Ry., for this information, Mr. Robert Quayle, superintendent of motive power and machinery, and Mr. E. M. Herr, assistant superintendent of motive power and machinery, assisted in the investigation.

WHY AN ELECTRIC MOTOR REVOLVES.

The action of the current in producing rotation in an electric motor is quite simple. The fundamental fact is the relation between an electric current and a magnet. If a piece of iron be surrounded by a coil through which the current is passed, it becomes a magnet. In Fig. 1 the passage of a current through the coil of wire around the iron bar in either direction, renders the iron a magnet, with all the well known properties of a magnet. It will attract iron, and the space surrounding it becomes magnetic. Iron fillings will arrange themselves in the direction shown by the dotted lines in the figure. One end of the magnet is a north pole and the other a south pole.

If a wire, such as CD, be moved past either pole of the magnet, there will be a tendency for current to flow in the wire either from C to D or from D to C, according to the character of the pole past which it is moved and to the direction of the movement. If the ends of the wire CD are joined by a conductor, so there is a complete circuit, a current of electricity will flow through the circuit. This circuit may be either a simple wire, as shown by the line CEFD, or it may be the windings on machines enabling the current to produce mechanical work, or it may be electric lamps producing light. The essential features is that there shall be a complete path from C to D for the current to flow, no matter how complicated that circuit may be.

*From a pamphlet by D. L. Barnes on Electric Locomotives published by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company.

The reason why there is a tendency for an electric current to flow in the wire CD when it is moved in the vicinity of a magnet is not known. There are several theories, all more or less involved and depending upon pure assumptions as to the nature of an electric current. For all practical purposes it matters not what the reason is; the fact that current flows when there is an electric pressure in a closed circuit, is the important thing, and it serves all useful purposes to know that current does flow, and that its direction and amount are always the same under similar circumstances.

The intensity of the electric pressure, or electro-motive force, depends upon the velocity of revolution of the wires and upon the strength of the magnets, and the quantity of current depends upon the electro-motive force and upon the amount of the resist-

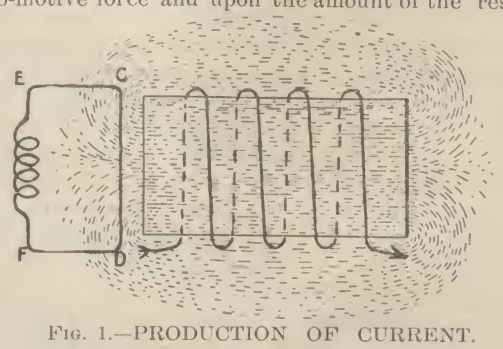


FIG. 1.—PRODUCTION OF CURRENT.

ance in the circuit. Other things being equal, the current through a long small wire, or greater resistance, will be less than through a short thick one, or a less resistance.

Having seen that when a wire is moved in the vicinity of a magnet an electric pressure is produced which will cause a current to flow in a closed circuit, one can easily conceive of many ways in which a current of electricity may be generated by combining magnets and wires so that there will be a relative motion between them. In order to make a continuous flow, the relative motion must be continuous; and if the current is to be uniform, the motion must be uniform.

Two electro-magnets are shown in Fig. 2, in which the north pole of one magnet is near the south pole of the other, and the magnetic field between the two lies in approximately straight lines between the two magnets, as indicated by the dotted lines. If the wire CD be moved across this field and its ends be joined, as by the dottted circuit CEFD a current will flow in this circuit. The wire CD may be made to revolve around the wire E F, passing in front of one pole and then in front of the other pole, as in Fig. 3. The current in the circuit will pass in one direction when the wire is passing one pole and in the other direction when it is passing the other pole. The connection between this elementary arrangement and the dynamo is easily recognized. In the dynamo a magnetic field is produced by electro-magnets called "field poles," and a considerable number of wires similar to the wire CD are placed upon an armature so that they revolve in front of the poles. Each individual wire produces current first in one direction and then in another direction, as explained above; but if there be many wires there will always be the same number in front of the north or positive pole and the same number in front of the south or negative pole, so that the total or resultant action is practically uniform and may be made to produce a continuous current. Such a machine is the common dynamo or motor.

A dynamo transforms mechanical into electrical energy, and a motor transforms electrical into me-

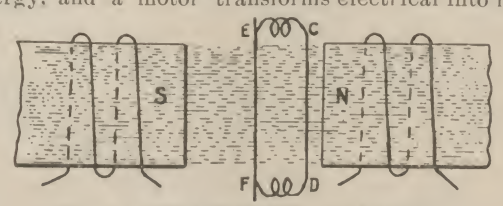


FIG. 2.—ELEMENTARY DYNAMOS.

chanical energy. The two operations are reversible and may be effected in the same machine: a dynamo may be used as a motor or a motor may become a dynamo. A machine is a motor when it is driven by a current of electricity, and it is a dynamo when it is driven by mechanical power and produces an electric current. If a motor be driven by an engine it can deliver a current of electricity which is able to operate other motors or electrical apparatus or lights. A simple form of electric machine is shown in Fig. 4, which is the general form of the electric motor. In this there are two projections of steel, H and G, which are made electro-magnets by the current going through the wires wound around them from any source of electricity, such as a battery at I and J. These magnets have poles facing toward drum, K, revolving on a shaft. The poles G and H are called the "salient" poles; the poles M and P are called the "consequent" poles. The magnetic flow or field are shown by the dotted lines. On the periphery of the drum are arranged wires in the slots shown. As the drum is revolved there will be a tendency for electricity to flow in the wires. In order to get a current of electricity from these wires it is necessary to make a complete circuit. As each of the wires in the slots passes in front of a pole a pressure or electro-motive force will be generated, and its direction will depend upon whether the pole is a north or a south pole.

The pressure or electro-motive force generated in the wires moving in front of the positive or north field poles will be in one direction, while those in front of the negative or south poles will be in the opposite direction. Therefore, if two such wires be connected together at one end of the armature, the free terminals of the wire at the other end of the armature will have the sum of the electro-motive forces generated in the two wires. The wires so connected can be considered as a turn of a single wire, instead of two separate wires, and this turn may be connected in series with other turns, so that the resulting electro-motive force is the sum of that in all the turns and all the wires so connected. It is customary to connect the coils of an armature so that the electro-motive force given is that obtained from half the coils in series. The other half of the coils is connected in parallel with the first half, so that the currents flowing in the two halves will unite to give a current in the external circuit equal to twice the current in the two armature circuits or paths.

It is evident that as the armature revolves wires which were in front of the positive pole will pass in front of the negative pole, and that in order to maintain the electro-motive force it will be necessary to

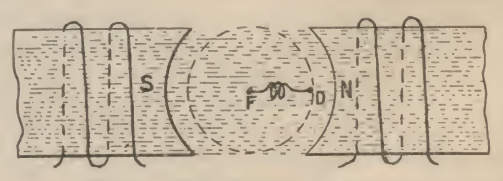


FIG. 3.—MAGNETIC CIRCUIT.

change the connections from the armature winding to the external circuit in such a way that all the wires between the two points of connection will have their electro-motive forces in the proper direction. The connection to the armature must therefore be made not at a definite point in the armature itself, but at a definite point with reference to the field magnets, so that all the wires between two points or contacts shall always sustain the same relation to the field magnets.

For this purpose a device known as a "commutator" is provided. The commutator is made up of a number of segments, as shown at A, in Fig. 5, which are connected to the armature winding. On the commutator are sliding contacts or brushes, which bear on the segments and are joined to an external circuit, making a continuous path through which current may flow. As the commutator revolves, the different segments come under the brushes, so that the relative position of the armature wires between the brushes is dependent on the position of the brushes. The armature wires which connect the brushes are those sustaining the desired definite position to the field magnets, so that the currents from the armature at all times flow properly into the external circuit, although individual armature wires carry currents first in one direction and then in the other direction, depending on the character of the pole in front of which they may be moving.

On two-pole machines there are two brush holders, each containing one or more brushes. On the four-pole machine there may be either two or four brush holders, and on a six pole machine either two, four or six brush holders.

A single path of the current through the commutator and armature winding is shown by the arrows on Fig. 5. The brushes B and C are placed on the top side of the commutator to make them more accessible, and this gives a peculiar but simple armature winding.

For the sake of simplicity, the batteries I and J, of Fig. 4, are not used on common forms of generators or motors, but the current that flows from the armature through the commutator is made to flow through the electro-magnets either in whole or in part. If all the armature current flows around the electro-magnets or fields of the machine, it is a "series" machine; if only a part of the current is used in this way it is a "shunt" machine; that is, some of the current is "shunted" through the fields. Sometimes

both the shunt and series windings are used, and in that case the machine is called a "compound wound" machine. Such a machine has a large wire through which the main current passes, and a fine wire through which the shunted current flows. Fig. 5 shows how the commutator and the fields are connected, and how the current flows from the wires in the armature through the commutator in a series machine.

If the current delivered by a dynamo does not flow in the desired direction, it can be reversed by shifting the wires in the binding posts or by throwing a switch. If the motor does not revolve in the desired direction, it can be made to do so by reversing the connections to the armature or field-coils; so that, without knowing which way a current of electricity is so be generated, any practical man can make a motor revolve in a proper direction by simply changing the connections.

It is natural that a machine which gives out electric energy when driven by an external power, will, when electric energy is delivered to it, reverse its action and give out mechanical power and do work. This is not a logical reason why a motor revolves under the influence of an electric current, but it is a natural inference which assists in comprehending the fact.

Perhaps the simplest way to explain the cause of the movement of an electric motor, when supplied with a current, is to compare the action to the well-known attraction of unlike poles or magnets and the repulsion of like poles. Unlike poles are north and south; like poles are two north or two south. In any motor the current through the field causes a north or south pole to be maintained, and the current through the armature and brushes causes an opposite

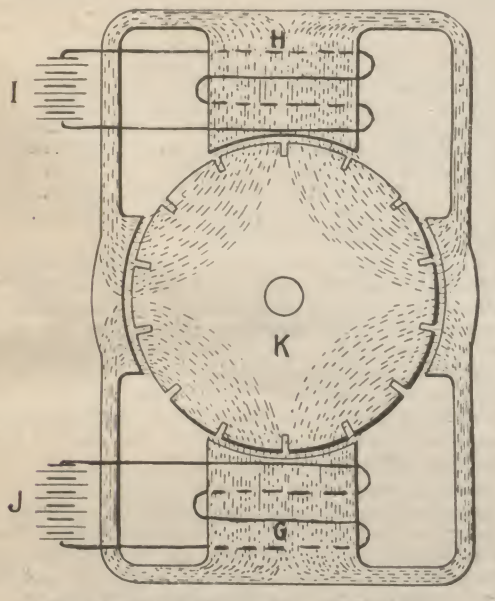


FIG. 4.—ELEMENTARY DYNAMOS.

polarity. These constantly maintained unlike poles attract each other and pull the armature around on its axis.

It has been explained that if a motor be driven by a belt an electro-motive force is produced and the machine acts as a dynamo. It is also a fact that an electro-motive force is produced whether the power for driving the machine is obtained from a belt or from the electric current—that is, whether the machine be driven as a dynamo or as a motor. In a dynamo, however, the current flows out in the direction in which the electro-motive force is acting. In a motor the electro-motive force produced has a direction opposed to the direction of the flow of current. This may be illustrated by the following experiment:

Two similar machines are driven independently at 600 revolutions and give an electro-motive force of 100 volts. Similar terminals of the two machines are connected together. No current flows between the machines because the two pressures are the same and are opposed in direction. If now the belt be thrown off from one machine its speed will begin to fall. This will lower its electro-motive force below that of the other machine or dynamo, but will not change the direction of the force. There will now be a difference of pressure in favor of the machine which is driven, and it will now send a current through the other machine and run it as a motor. The speed of the motor will continue to fall until the difference in pressure or electro-motive force between the two machines is just sufficient to cause the flow of enough current to keep the motor running against whatever frictional resistance and other resistance there may be. The electro-motive force generated in the motor which is against or counter to that of the current in the circuit, is called the "counter electro-motive force."

In order to determine how fast a motor will run without doing work under any given pressure, it is not necessary to know anything about the dynamo that furnishes the pressure. The pressure alone is sufficient to determine the speed of the motor. For instance, if a motor will give a pressure of 500 volts

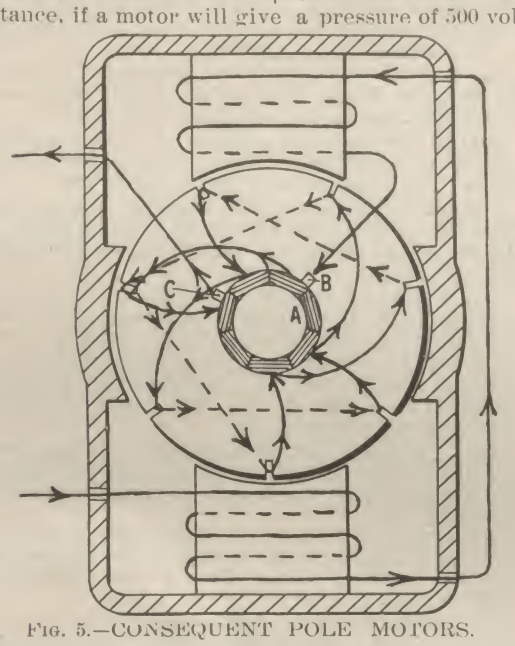


FIG. 5.—CONSEQUENT POLE MOTORS.

when running free at 100 revolutions, it will always run at about 100 revolutions when not doing work on any electric circuit where the pressure is 500 volts.

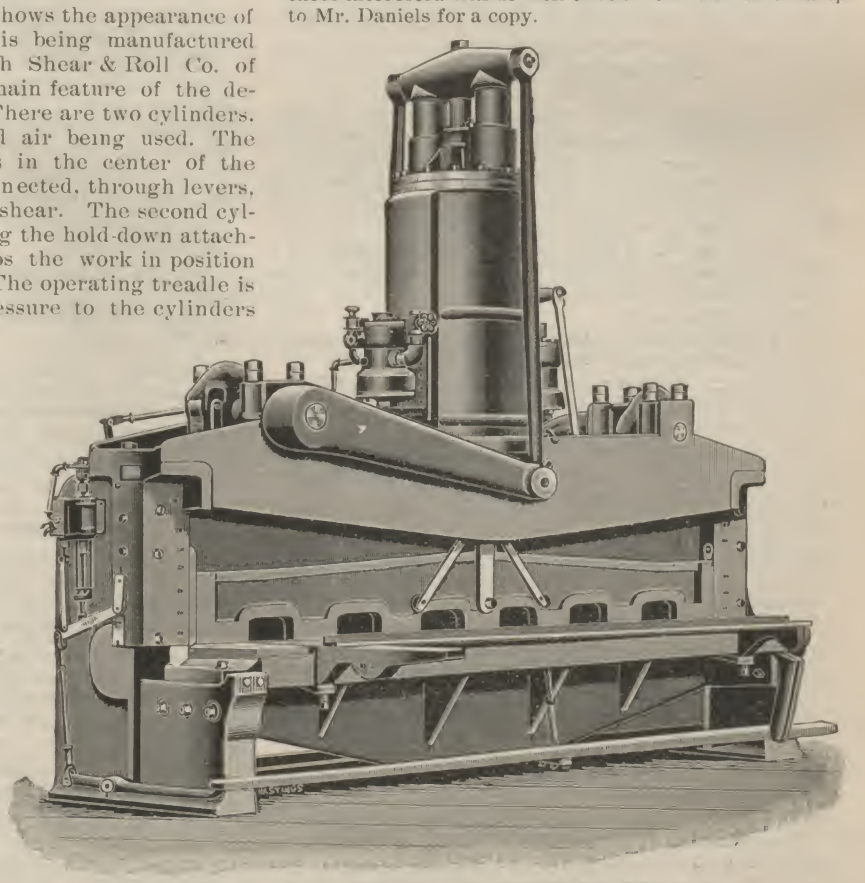
This description of a motor or dynamo carries with it all of the fundamental theory of electrical generators and motors that it is necessary for a mechanic to know in order to take reasonably intelligent care of electric locomotives. Further useful knowledge must be attained by studying the different types of electric motors and dynamos. These other types all have the same fundamental theory, even when the construction is quite different. It has been the aim in devising these electric locomotives to adhere as closely as possible to a uniform type for all sizes, so that when a mechanic has once grasped the fundamental design of one size he will be familiar with the other sizes.

STEAM OR COMPRESSED AIR SHEAR.

The illustration herewith shows the appearance of a direct acting shear which is being manufactured by the Cambridge City Punch Shear & Roll Co. of Cambridge City, Ind. The main feature of the design is its direct action. There are two cylinders, either steam or compressed air being used. The main or shearing cylinder is in the center of the machine and its piston is connected, through levers, with the upper knife of the shear. The second cylinder is used for manipulating the hold-down attachment which securely clamps the work in position after it has been adjusted. The operating treadle is attached so as to admit pressure to the cylinders simultaneously, but the piston of the hold down cylinder acts in advance of the other, so the work is lamped befcore it is touched by the shear. This clamp is entirely automatic in its action and needs no adjustment for work of different thicknesses, as the piston moves only a distance sufficient for bringing the clamps down, and is then held in that position by the pressure.

The great advantage in this design is that it is impossible to overwork or strain the machine by inserting work too heavy for it.

The various parts are given sufficient strength to withstand any strain which can be obtained by the rated working pressure, and an increase of this pressure can be prevented by the use of a safety valve. Another advantage is in the fact that the machine can be stopped or reversed at any point in either the up or down stroke. It is therefore at all times absolutely under the control of the operator, and the shear will ascend at any time immediately on the treadle being released. This is a great safeguard against breakage in case a heavy piece of metal should carelessly be left under the knife. It is claimed that on a single size of machine a great variety of work can be done to advantage, that is, that narrow stocks can be cut just as rapidly on a 10 ft. shear as on a 3 ft. It is further claimed that the action of the machine is more rapid than that of other designs; so much so that from 30 to 50 per cent more work can be turned out in a given time than can be on an ordinary geared machine.



A SHEAR FOR STEAM OR COMPRESSED AIR.

The Central Railway Club.

The next meeting of the Central Railway Club will be held at the Hotel Iroquois, Buffalo, N. Y., Friday, Sept. 11, 1896, at 2 p. m. The following committee reports will be received:

"Car Roofs". Committee: E. A. Miller, chairman; S. A. Crone, E. A. Mitchell, A. C. Robson, Robert Potts, Thomas Sills. "Comparative First Cost and Cost of Maintenance of Planished Iron Locomotive Boiler Jackets and the Plain Sheet Iron or Steel, Painted". Committee: J. H. Moore, chairman; Amos Gould, P. E. Garrison, F. B. Griffith, John Campbell, H. Tandy. A discussion will be held on the report of the committee on "Tool Rooms in Machine Shops and Best Methods of Handling Them." Time will also be given to topical discussions.

The Western Society of Engineers.

At the regular monthly meeting of the Western Society of Engineers held in the Monadnock block, Chicago, on Wednesday evening, September 2, 1896, an able paper on "Street Pavements in Chicago" was presented by Mr. C. D. Hill. In the discussion which followed the reading of the paper some interesting facts and features of a practical nature were developed as to the various conditions and requirements to be considered in deciding upon the merits and adaptability of materials for a durable and desirable pavement. At the meeting which will be held September 16, papers will be presented upon the subject of "Parks and Roads" by Messrs. H. C. Alexander and J. F. Foster.

NOTICES OF PUBLICATIONS.

Under the title, "New York as a Summer Resort", Mr. Geo. H. Daniels, general passenger agent of the New York Central & Hudson River Railroad, has brought out a pleasing addition to the "Four Track Series" which presents the many attractions of the city of New York, and neighborhood, as a place for entertainment and care of summer visitors. It is from the press of the American Bank Note Company. The illustrations are good, and those interested will do well to send two two cent stamps to Mr. Daniels for a copy.

SWITCHES AND FROGS; Elliot Frog & Switch Co., East St. Louis, Ill.; 4x7 in.; leather; illustrated; pp. 150.

This is a neat catalog of switches, frogs, crossings, switch stands and accessories, giving the special features of the product of the Elliot Frog & Switch Co. It is a careful revision of the last catalog issued, bringing the material up to date, and including a number of practical rules for the assistance of trackmen, which are accompanied by diagrams of turnouts, bills of timber and other valuable information for these men. Among the frogs

special mention may be made of the Eureka spring rail frog. There is also a double spring frog shown which is specially designed for use in yards, and which is intended for use where the service is equally heavy on both tracks. This frog is in all respects like the well known Eureka spring frog except that both side rails are movable. Several of the frogs are shown with foot guards. Among the switches are the usual split and three-throw switches, a derailing switch connected with the main turnout switch for the protection of sidings. and a lap switch which is recommended in preference to the common stub switch. A combination lap switch crossing is illustrated among the slip switches, the cost of the lap pattern being much less than the ordinary point switches in this application on account of less material being required. At the end of the book attention is given to track tools, wrecking frogs, chairs and rail joints, the joint illustrated being the Doddridge clamp pattern.

OUR PATENT RECORD.

(Our record of patents that most interest our readers is compiled regularly by our Washington correspondent with the idea of being a complete index. Space forbids more than the citing of a reference, but the complete specification or drawing of any patent desired will be mailed to any address upon receipt of 10 cents in stamps, and other information in regard to patents will be cheerfully given. Address all communications to our correspondent, Edw. C. Weaver. Attorney and Counselor, McGill Building, Washington, D. C.)

566,749, car coupling, James Farlow, Greencastle, Ind., assignor of one-half to Jack Simpson, same place, filed Jan. 31, 1896. Serial No. 577,574 (no model).

566,814, car brake, Wilber H. Tallman, McKeesport, Pa., filed Oct. 15. 1895. Serial No. 565,716 (no model).

566,822, car coupling, Wm. T. Van Dorn, Chicago, Ill., filed Jan. 11, 1896. Serial No. 575,187 (no model).

566,828, tie guard or plate, Thaddeus S. Weed, Chester, Pa., filed March 19, 1895. Serial No. 542,312 (no model).

566,857, sanding apparatus for locomotives, Chas. F. Gage, Schuylerville, N. Y., filed Oct. 8, 1895. Serial No. 565,048 (no model).

566,876, car coupling, Wm. G. Smith, New Haven, Conn., filed Sept. 13, 1895. Serial No. 562,467 (no model).

566,887, detector for railway switches, Wm. H. Berrigan, Jr., Brooklyn, N. Y., filed April 26, 1895. Serial No. 547,224, (no model.)

566,904, car heating apparatus, Edward E. Gold, New York, N. Y., filed June 6. 1895. Serial No. 551,923, (no model.)

566,907, car coupling, John F. Hay, Erie, Pa., assignor to the Erie Malleable Iron Co., Ltd., same place. Filed June 22, 1896. Serial No. 596,405, (no model).

566,991, car coupling, Joseph D. Majors, Macedonia, Ala., filed Feb. 3, 1896. Serial No. 577,876, (no model.)

567,024, air brake, Dennis Dunn, Mahanoy City, Pa., assignor of one-half to John E. Reyburn, Philadelphia, Pa. filed July 31, 1895. Serial No. 557,699, (no model.)

567,109, car coupling, Thos. J. Orr, Ladonia, Tex., assignor of two-thirds to Robt. M. Estill and John Huber, same place, filed Dec. 31, 1895. Serial No. 573,923, (no model.)

TECHNICAL MEETINGS.

The Engineers' Club of Philadelphia meets on the first and third Saturdays in each month, at 8 p. m., at the house of the club, 1122 Girard street, Philadelphia, Pa.

The Civil Engineers' Club of Cleveland, meets on the second and fourth Tuesdays in each month, at 8 p. m., at the Case Library building, Cleveland, Ohio.

The Association of Engineers of Virginia, holds its informal meetings on the third Wednesday of each month from September to May inclusive, at 8 p. m., at 710 Terry building, Roanoke, Va.

The Western Railway Club of Chicago, holds its meeting on the third Tuesday of each month.

The Central Railway Club meets on the fourth Wednesday of January, March, April, September and October, at 10 a. m., at the Hotel Iroquois, Buffalo, N. Y.

The Denver Society of Civil Engineers meets on the second and fourth Tuesdays in each month except July, August and December, when they are held on the second Tuesday only, at 36 Jacobson building, Denver, Colo.

The Western Society of Engineers holds its regular meetings for the transaction of business and the reading and discussion of papers on the first Wednesday of each month except January.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p.m., at the House of the Society, 127 East Twenty-third street New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each mouth, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West Thirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumberland Publishing House, Nashville, Tenn.

Annual meeting Traveling Engineers' Association, Minneapolis, Minn., Sep. 8, 1896. W. O. Thompson, secretary 415 Marion street, Elkhart, Ind.

Annual Convention Roadmasters' Association and Road and Track Supply Association, Cataract Hotel, Niagara Falls, N. Y. second Tuesday in September, 1896.

The Railway Signaling Club holds its meetings in Chicago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, S. T. Johnstone, 1522 Monadnock building.

The Technical Society of the Pacific Coast has a monthly meeting on the first Friday in each month at 8 p. m., at the Academy of Sciences building, 819 Market street, San Francisco, Cal.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m. at the Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

PERSONAL.

Mr. George Haskell has been appointed superintendent of the Lima Northern road, vice Mr. W. C. Rising, resigned.

Mr. E. B. Sankey has resigned as superintendent of the Salem branch of the St. Louis & San Francisco, and the office has been abolished.

Mr. W. T. Webster had been appointed commercial agent of the Louisville, New Albany & Chicago, with headquarters at Grand Rapids.

Mr. J. Q. Hicks, in charge of the Big Four's Indianapolis terminal yards, has appointed Mr. Ralph Kensington yardmaster of the Chicago division.

Dr. C. B. Fry has been appointed chief surgeon of the Peoria, Decatur & Evansville, with headquarters at Mattoon, Ill., vice Dr. G. M. Young, resigned.

Mr. George Daly brother of General Passenger Agent C F. Daly of the Brice lines, has been appointed cashier of the Cleveland, Akron & Columbus, also a Brice line.

General James Jourdan has been appointed temporary receiver of the Kings County Elevated road, pending the determination of an action for the appointment of a permanent receiver.

Mr. C. P. Gaither, New England agent of the Norfolk & Western lines, will on Sept. 15 sever his connection with that company and enter the service of the Plant system in the same capacity.

Mr. J. C. Chase agent of the Blue and Canada Southern freight lines in Buffalo, N. Y., has had his responsibilities increased by being also appointed commercial agent of the Michigan Central.

On Sept. 1, Mr. F. M. Rummel took charge of the Lansing Division of the Lake Shore & Michigan Southern Railway as roadmaster, with headquarters at Hillsdale, Mich., vice Mr. A. Storms resigned.

The position of general baggage agent on the New England road has been abolished and Mr. W. R. Babcock, general passenger agent of the road, will hereafter look after the duties of the position.

A circular has been issued appointing Mr. G. W. Turner to the position of bridgemaster of the St. Louis & San Francisco, while Mr. W. T. Smetten has been made general roadmaster of the same road.

Mr. L. Koehne, city passenger agent of the Cincinnati, Hamilton & Dayton and the Monon at Indianapolis, has tendered his resignation to engage in other business. His successor has not yet been selected.

It is reported that the Atchison, Topeka & Santa Fe will not appoint an auditor to succeed the late Mr. J. F. H. McKibben, but will consolidate the office with that of Mr. H. C. Whitehead, general auditor.

Mr. Stephen Kennedy, passenger agent for the Pennsylvania lines in Maryland, died at Atlantic City on Tuesday, August 24. Mr. Kennedy had been with the passenger department of the Pennsylvania twenty years.

Mr. W. W. Miller, who has been commercial agent of the Missouri, Kansas & Texas at Kansas City, has been appointed general live stock agent of the company at Fort Worth, Texas, succeeding Mr. R. Jones, resigned.

Mr. Charles Alexander, who has been connected with the Union Star line at Louisville, has been transferred to Chicago and given the title of traveling freight agent of the Union line, operated by the Pennsylvania road.

Mr. F. A. Leland, chief clerk to Traffic Manager Miller of Missouri, Kansas & Texas, has been appointed assistant general freight agent of the company, with headquarters at Kansas City. Mr. Leland is a young railroader and deserves the promotion given him.

Mr. R. McC. Smith is appointed southern passenger agent of the Grand Trunk Railway, with headquarters at Cincinnati, vice Col. D. S. Wagstaff, resigned. Mr. C. W. Graves, traveling passenger agent, London, Ont., has been removed to Union Station, Toronto, Ont.

A circular issued by the Union Despatch Line announces that Mr. G. W. Stahlman of Nashville had been assigned to succeed Mr. Alf G. Tuther as agent for the line in Memphis. Mr. Tuther is transferred to other duties. Mr. D. A. Lindsey will succeed Mr. Stahlman in Nashville.

Mr. C. H. Chappell, Jr., has been appointed soliciting freight and passenger agent of the Seaboard Air Line at Memphis, Tenn., to succeed Mr. R. G. Browning, who, it is understood, will soon accept a position with with another line. Mr. Chappell is a son of Vice President and General Manager C. H. Chappell of the Chicago & Alton.

Mr. G. D. McDill, formerly in the office of the general superintendent of the Fremont, Elkhorn & Missouri Valley, has been appointed chief clerk to the general manager of the Omaha. He assumed the title and duties of the position yesterday. He succeeded Mr. Harry Gemmell, now chief clerk and private secretary to President Winter of the Northern Pacific.

The resignation of Mr. W. E. Cole, claim agent of the Wheeling & Lake Erie, has been announced. Mr. Cole leaves the service of the company to go into business for himself. Mr. Cole's successor will be Mr. C. C. Needham. Mr. Needham has been connected with the Lake Shore in the same capacity for over fifteen years and is considered a good man for the place.

Mr. Dewey Drake, city passenger agent of the Big Four at Indianapolis, died Saturday night at 11 o'clock on a Grand Rapids & Indiana train as it was going into Grand Rapids. His death was caused by heart failure. Mr. Drake had been with the Big Four road for nearly fifteen years. He was formerly an express messenger on the old I. P. & C. road, but he left that and drifted into passenger work.

The position of auditor of the Kansas City, Memphis & Birmingham at Memphis, has been abolished and in future Mr. Cyrus Garnsey, Jr., who has held that position, will be assistant to Comptroller J. S. Ford at Kansas City. The office also of cashier and paymaster which has been at Memphis will be removed to Kansas City, and will be in charge of Mr. James H. Aldrich. Mr. Chas. Keeler, who has been in charge of that position at Memphis, has been assigned to another department.

Mr. W. P. Adams, who has been soliciting freight agent for the Kansas City, Memphis & Birmingham, at Birmingham, Ala., will go to Memphis as contracting freight agent for the same line at Memphis. Mr. Adams has been connected with the Kansas City for a long time in the freight department, coming to that road from the Georgia Pacific, where he was traveling freight agent. Mr. E. T. Wilcox, in addition to being the chief clerk to the assistant general freight agent in Birmingham, will also be the contracting freight agent for that city.

Mr. Thornton Lewis has been appointed manager of the Kanawha Dispatch, with headquarters at Cincinnati, the appointment to be effective on September 1. The Kanawha Dispatch operates over the Chesapeake & Ohio, Chesapeake & Ohio Southwestern, Southern Railway, Atlantic Coast Line, Big Four, Ohio Central, Kanawha & Michigan, Chicago, St Louis & Pittsburgh, Virginia Midland, Louisville & Nashville, Louisville, Evansville & St. Louis, Louisville, Cincinnati & Mexican, Old Dominion Steamship Co., Merchants' & Miners' Transportation Co. and Clyde Steamship Line.

Mr. Wm. Sullivan, agent of the Big Four at Indianapolis on September 1 retired from that position to take the position of commercial agent of the company at that point, and his associates thought it a fitting time to kindly remember him. He was accordingly presented with an elegant gold watch and chain, costing $150, by the employes, many of whom he had been associated with for twenty years or more. Mr. Sullivan has been in the employ of the Big Four nearly twenty-four years, commencing as a messenger boy.

Vice President Theodore Voorhees of the Reading Railroad has appointed Mr. John S. Carter to be at the head of the department of stationary and printing supplies, with the title of stationary clerk, vice Mr. W. H. Brown, deceased. The appointment embraces a corresponding position with the Philadelphia & Reading Coal & Iron Company, the Atlantic City Railroad and other affiliated companies. It is considered a place of considerable importance and responsibility, controling the distribution of vast quantities of valuable supplies to hundreds of offices and agencies, extending from Boston to Chicago. Mr. Carter is a native of Philadelphia and entered the Reading's service in September 1878, as an office boy in the department of which he has just been made chief.

Col. D. F. Whitcomb, for some years superintendent of the Union Railway Co., with headquarters at Indianapolis, and the Belt road, died at Potter Place, N. H., on Saturday, at the residence of his brother. Mr. Whitcomb began railroading when young on the Vermont Central, and about twenty years ago came west and entered the service of the Cincinnati, Hamilton & Dayton under the McLaren administration; a few years later he went to the Louisville & Nashville as a division superintendent, and in 1880 was appointed superintendent of the Union Railway Co. and the Belt road, which position he held until the appointment of Mr. A. A. Zion as superintendent two years ago. The deceased had been out of health for two

years, and a few weeks ago went to his old home to remain a while, hoping that the air of New England would restore his health.

Dispatches from Tacoma, Wash., announce a number of changes on the Northern Pacific, among which is the retirement of eight of the present officials. The most important are Mr. A. F. Burleigh, receiver; Mr. G. W. Dickinson, formerly assistant general superintendent, and now general manager under Burleigh; Mr. James M. Ashton, formerly western counsel, now chief counsel for Receiver Burleigh, and Second Vice President C. H. Prescott, formerly general manager of the Oregon Transcontinental and Oregon Railway & Navigation Co. None of these have been re-elected. The other officers who will go out on Sept. 1 are Attorney W. C. Chapman, General Manager Kingley of the Northern Pacific Ry. Co., Assistant Purchasing Agent D. Mason, and Assistant Superintendent of Telegraph J. Q. Mason.

RAILWAY NEWS.

Ann Arbor.—Specifications for the enlargement and improvement of the Ann Arbor terminals at Toledo, Ohio, are being gotten out and it is thought probable that the work will be completed before winter. The changes include the addition of four new stalls to the roundhouse, thus nearly doubling the capacity of the building. Quite a large addition will be built to the coal dock and a number of other improvements will be made. The company has found this necessary in order to make room for the Flint & Pere Marquette which expects to be running into Toledo by the middle of September.

Dubuque & Sioux City—Cedar Falls & Minnesota.—Papers have been filed at Waterloo, Ia., transferring the Cedar Falls & Minnesota R. to the Dubuque & Sioux City R. Co. A trust deed was executed to the United States Trust Co., of New York, for $4,575,000. The line is 79 miles long, and extends from Waterloo to Lile, Minn. It was sold under foreclosure on June 1 for $600,000 and was bid in by Chicago parties.

Kansas City, Pittsburg & Gulf.—Reports in many of the daily papers this week have stated that work on the Kansas City, Shreveport & Gulf division of this road had been discontinued, but it seems such will not be the case. To stop work now meant great hardship not only to the employes of the road but many people living along the line who are distressed already by the drought and shortness of crops. It is stated that on the line of the Kansas City, Pittsburg & Gulf new towns are springing up rapidly and the country is being developed surprisingly. It is also stated that within four weeks the town of Mena, Ark., has come into existence and already has a population of 3,000 people. It is reported that contracts have been let for the construction of a branch from a point in Polk county, Ark., to Hot Springs, and may be extended to Little Rock. At present there is a gap of 50 miles to be filled in before the main line is completed to Texarkana. A large force of men is still at work. Mr. E. L. Martin is president and Mr. R. Gillham is chief engineer, both of Kansas City.

Kings County Elevated.—The Kings County Elevated R. Co., operating in Brooklyn, has been placed in the hands of a receiver. The application for a receiver was made before Judge Goodrich in the supreme court by Tracy, Boardman & Platt, in behalf of petitioners James H. Frothingham, treasurer, and August Belmont, vice president of the Kings County road, and Vermilye & Co., bankers. The charter of the Kings County Elevated road was filed on January 6, 1879. The actual construction of the road, however, was not begun on the Fulton street line till the early part of 1886. The work had only continued a few weeks when it was interrupted by legal proceedings. The validity of the charter and franchise of the company was bitterly assailed. One delay followed another, and it was not until March 22, 1887, that a decision of the court of appeals favorable to the charter and franchise as to Fulton street removed all legal impediments. On April 24, 1888, 3.15 miles of the road had been completed and was opened for travel between Brooklyn bridge and Nostrand avenue. By May 30 the line was extended to Albany avenue, on August 29 to Utica avenue, making 4.15 miles of road in operation. The Fulton Elevated Co. was organized that year, and on June 1, 1889, it was leased to the Kings County road. The tracks were extended to the city line, and then into the twenty-sixth ward as far as the crossing of Atlantic and East New York avenues. As fast as the Fulton company extended its tracks it leased them to the Kings County road. Two or three stations were added every year until the road was extended from Brooklyn bridge to the city line at the westerly boundary of the town of Woodhaven. In the latter part April of last year proceedings were concluded by which the two companies were merged into one under the name of the Kings County Elevated R. Co. There are now in operation a fraction over 8 miles of road, which was constructed at a cost of $14,304,503. The petitioners claim this is a friendly action for the purpose of adjusting affairs and protecting the interests of stockholders. They say that there are a number of outstanding debts they cannot yet meet. Poor business, due to the trolley system, is also given as one of the reasons. The capital of the company is $4,750,000.

New York & Pennsylvania.—The new branch of the New York & Pennsylvania, 42 miles in length, running from Oswayo to Canisteo to connect with the Erie, will be completed this week.

Northern Pacific.—A decision was rendered by ex-secretary Smith on August 28 on application of the Northern Pacific fixing the eastern terminus of the road under the grant and determining the status of lands embraced within the limits of this grant between Carlton and Duluth. The secretary last November decided the company had no grant between Superior and Ashland, and left the question of the eastern terminus for future consideration. In his later decision he decided that the eastern terminus under the grant must be established at Duluth, and the company's rights east of Carlton determined accordingly. In the adjustment of the company's grant, land previously granted to the Lake Superior & Mississippi, five alternate sections per mile on each side of the railroad in Minnesota, must be deducted from the amount of land granted to the Northern Pacific. This Lake Superior & Mississippi had a prior grant over the same general route covered by the Northern Pacific, and in order to save expense the latter entered into confederation with the former company by which it used its tracks between Carlton and Duluth. The Northern Pacific claimed that it was entitled to its full quota of 20 sections per mile on each side of the road without regard to prior grant. In this decision the secretary states: "The Northern Pacific will not be entitled to any lands within the common limits of the grant, nor can it have indemnity for the same as lands lost in place. The amount of prior grant is to be deducted from the amount of the Northern Pacific grant. Between the points named before, the Northern Pacific will take only granted lands within lateral lines of its own grant which fell outside the limits of the former grants, and will be entitled for indemnity only for loss sustained outside of the limits of the former grant. The commissioner of the land office has therefore been directed to proceed with the adjustment of the Northern Pacific grant between Carlton and Duluth in accordance with his decision.

There are many rumors of the construction of depots and buildings about to be undertaken by the Northern Pacific, notably an alleged magnificent depot at Seattle. President Winter, however, is reported as saying that the advisability of erecting a depot at Seattle, as at several other points, has been discussed, and no doubt depots and other buildings will be erected before long, though how many or of what dimensions no one can say. The improvements now being made in track structures, such as the substitution of steel for wooden bridges, in alignment, in the correction of grades and the laying of about 200 miles of steel rail, began a long time ago, and will be completed in about a month. The cost of these improvements is great.

Rio Grande Southern.—According to the annual report just issued by the Rio Grande Southern, the income of the company from all sources during the fiscal year ending June 30, 1896, including $1,375.81 received from interest, was $490,609.82, an increase of $87,747.82 compared with the previous year. The gross earnings from the operation of the railroad were $489,234.01, being an increase of $86,435.90. The working expenses were $255,007.66, an increase of $53,205.24, making the net earnings from traffic $234,226.35, being $33,230.66 more than for the previous year. The increase in gross earnings is 21.46 per cent; in expenses, 26.36 per cent, and in net earnings 16.53 per cent. The net income from traffic and interest received afforded a surplus of $66,705.97, after providing for interest on funded debt, taxes, insurance, and all other charges against income. For detailed information you are referred to the statement of earnings and expenses, income account and balance sheet, prepared by the auditor and submitted herewith for your information. During the last fiscal year the following improvements were made: 422 tons of 45 lb. steel rail were purchased and laid, replacing some of the 30 lb. rail in the main line between Hesperus and Durango, and about 4 miles of this portion of the track were ballasted with gravel. During the year, 38,104 ties were used, and 28,143 additional were received and paid for and will be placed in the track before autumn. A new and commodius depot at Mancos was erected, and quite a number of minor improvements were made in the various buildings and structures along the line. The cost of all these improvements, including excess weight of rail, was charged to operation account. The company has 162 miles of main line, extending from Durango to Ridgway, 18 miles of branches and 19 miles of sidings, making a total of 199 miles of track, all 3 ft. gage.

Southern.—The annual report of the Southern R. Co. for the year ending June 30, 1896, just issued, shows gross earnings of $19,082,247, an increase of $1,967,456; expenses and taxes, $13,451,448, an increase of $1,388,594; net earnings, $5,630,790, an increase of $578,682; gross income, $5,819,307, an increase of $677,693; interest, rentals, etc., $5,262,289, an increase of $1,016,959, and profit and loss balance, $556,478, a decrease of $339,266. The report recites that in addition to the expenditures for new construction and improvements and for new equipment charged to capital account, marked improvements have been made during the year in the physical condition of the road and equipment, the cost of which has properly been charged to operating expenses. Among such items may be mentioned 79 miles more of 80 lb. steel rail, 130 miles more of 75 lb. steel rail, and 126 miles less of iron rail in the main tracks than at the close of the fiscal year ended June 30, 1895; also 3,660 lineal feet of wooden bridges and trestles have been renewed with steel structures; 151 miles of additional stone and gravel ballast have been placed in track, and 2,232 lineal feet of trestle have been filled with earth or stone. The principal lines of the system are in such physical condition that immediate and considerable reductions can safely be made in expenses for maintenance to meet the present depression in business. The amount standing to the credit of profit and loss as the result of two years' operation is $1,452,223. The company has no floating debt, and the excess of current assets over current liabilities at the close of the year was about $1,000,000. Fifteen per cent of the tonnage was composed of agricultural products, less than 4 per cent being cotton. Forty per cent was received from mines and mining industries and over 25 per cent consisted of the products of manufactories. During the year $381,062 of equipment trust notes created by the old company and receivers were retired, leaving the amount outstanding $577,257. Sinking fund payments on account of equipment bonds amounted to $172,025. Expenditures on account of the new construction and improvements aggregated $758,842, and for new equipment $1,002,987. No equipment trusts have been created since the organization of the new company. Expenditures for the year were 70.40 per cent of the gross earnings as compared with 71.57 for the previous year.

A rumor is afloat in railroad circles, but as yet lacks confirmation, that the Southern system is reaching out to acquire the Norfolk & Western R. The rumor states that arrangements for the deal have been practically completed, and that the transaction will be formally closed at the foreclosure sale, which, it is understood, will take place during next month at the farthest. The main lines of the Norfolk & Western extend from Norfolk and Portsmouth, Va., to Bristol, Tenn.; from Roanoke, Va., to Hagerstown, Md., and from Radford, Va., to Columbus, O., a total mileage of about 1,400 miles.

Southern Pacific.—A number of improvements are being inaugurated by the Southern Pacific in both Texas and Louisiana. At Algiers, in the latter state, where ferry inclines have been built, and a steel viaduct 1,800 ft. long has been erected. Twenty-five miles of double track have also been built in Louisiana. Steel rails have been laid on various divisions and work is progressing on the coast line. When it is completed, through passengers will be carried along the Pacific shore instead of through the San Joaquin valley. About 1,000 extra men have been employed this summer.

The Southern Pacific was organized and granted a charter under which business is now being done in the state of Kentucky in 1884 and since that time only a broker's license has been paid. Attorney General Taylor of Kentucky discovered that the road is liable for a franchise tax and a tax on personal property. General B. W. Duke, attorney for C. P. Huntington, has assured the authorities that the Southern Pacific will pay the additional taxes.

Texas Midland.—The party of surveyors locating an extension to the Texas Midland to Milford has finished their work, and it is the general opinion that the Midland will intersect the Missouri, Kansas & Texas at that point. A press report from Terrell, Tex., says: "The train service over the Garrett branch of the Texas Midland R., embracing two miles of track between Midland Junction and Garrett will be discontinued September 1. Garrett was at one time the terminus of this branch of the Houston & Texas Central R. After its purchase by E. H R. Green the name was changed to the Texas Midland R., and an extension was built into Ennis from Midland Junction, Ennis then becoming the terminus. Since that time trains have been running into Garrett, as is required by the old charter, but no business was done at that point. The yard here and those all along the line are full up with material for construction purposes." The entire force of the Bethune-Craney Construction Co., the contractors engaged in building the extension from Commerce to Paris are busily engaged in laying off and grading the yards at that place. Work along the line, so far as grading is concerned, has been practically completed. Tracklaying is in progress between Paris and Cooper, about 1½ miles being laid per day. Work on the depot will begin this week. It is also talked that the company may build an extension from Ennis to Italy, Tex., a distance of 20 miles. The main line is now 73 miles long. Chief Engineer M. Duvall, Terrell, Tex.

Yankton, Norfolk & Southwestern.—A mortgage for $100,000 executed by Messrs. W. H. Edmunds and G. B. Swinhoe, president and secretary of the proposed Yankton & Norfolk road, has been filed with the register of deeds in favor of the London Railroad & Land Syndicate. The property mortgaged covers less than four miles of graded roadbed and right of way on the Yankton side of the Missouri river. A mortgage for $1,000,000 on the roadbed on the Nebraska side, extending from Yankton to Norfolk has also been placed on file. The London Railroad & Land Syndicate is composed of the English creditors of J. T. M. Pierce, and it is said that the project will be completed at once.

NEW ROADS AND PROJECTS.

Iowa.—A direct air line from Minneapolis, Minn., to Galveston, Tex., via Atlantic and western Iowa is one of the projects being at present talked up. From Minneapolis south it is proposed to use the tracks of the Minneapolis & St. Louis R. as far as Angus. The main line of this runs from Minneapolis to Des Moines, thence to St. Louis, but at Ogden a branch runs down to Angus. The distance from Angus to Atlantic is 64 miles. For the past week parties have been looking over the ground and conferring with leading citizens of the principal towns through which it is proposed to secure right of way, and considerable encouragement, together with proffers of substantial aid, have been extended. Steps are being taken to call an election for the purpose of voting a per cent tax to aid in the construction of the line. From Atlantic the route is straight to Galveston, Tex.

Washington.—Work on the Red Mountain road which is to connect Rossland with the city of Spokane by forming a connection with the Spokane Falls & Northern at Northport is progressing rapidly, there being 250 men employed

in the construction. A charter was obtained from the provincial government some three years ago by Mr D. C. Corbin and less than two years since he obtained a renewal of the charter, which would have lapsed in April last. There was considerable opposition to the renewal, because Mr. Corbin had up to that time done nothing to show his bona fide intention of going on with the work. The marvelous progress made in Trail Creek since that time and the discoveries of rich and immense ore bodies in nearly every mine that has been developed to any extent have made the construction of the road a pressing and immediate want, and the ever increasing output of ore, which is far beyond the capacity of the Columbia & Western Railway to carry, will be sufficient to guarantee the Red Mountain Railway a profitable traffic as soon as the company can get the road in operation. It is expected to commence tracklaying by September 10. The grade from Northport to Rossland will average about three feet in a hundred, Northport being about 1,300 ft. above sea level and the altitude of Rossland at the Nickel Plate mine being 3,400 ft. The actual distance of the road will be twenty-two miles, there being many curves, and one loop, where the sharpest curve exists. The grade is fairly easy until the canon is reached, about ten miles down, where the surveyors had to use ropes in the survey work. This is probably the worst bit of road on the whole line. Big Sheep creek is crossed on the level by a trestle bridge, and the road crosses the Northport wagon road no less than eight times. The report comes that in making a grade on the Red Mountain Railway, when crossing the Rainy Day mineral claim, boulders of coarse galena, carrying silver and free gold were found. The galena was only float, but the indications are that it did not come far and probably a vein similar to that of the Mayflower may be discovered. The contractors are Messrs. Stewart & Welsh.

West Virginia.—Surveys are now being made for the extension of the south branch of the Baltimore & Ohio road. The present line extends from Greensburg to Romney and it is proposed to extend it to Moorfield, thus opening up extensive lumber and cattle region.

INDUSTRIAL NOTES.

Cars and Locomotives.

—Mr. Henry G. Morse has accepted the presidency of the Harlan & Hollingsworth Co., ship and car builders, succeeding Mr. W. Taylor Gause, resigned. Mr. Morse was formerly president of the Edge Moor Bridge Works.

—The Lebanon (Pa.) Manufacturing Co. has shipped 42 new hopper cars to the Philadelphia & Reading Railroad Co. They are the first of an order of 500, and are of 60,000 lbs. capacity.

—Three 60 ft. postal cars have been completed by the St. Charles (Mo.) Car Works for the St. Louis, Iron Mountain & Southern Railway which embody several distinct improvements which originated in the mind of General Superintendent Peck of that line.

Bridges.

—The Youngstown (Ohio) Bridge Co. has completed and shipped a large girder bridge for the L. S. & M. S. Ry. Three flat cars were required to carry it. The bridge is complete, ready to be put in position on arrival at destination.

—It is reported that McKerney Bros., of Carthage, Mo., has been awarded the contract for the masonry for the Blair line railway bridge over Osage creek at Osceola, Kansas, and that the Wisconsin Bridge Co. of Milwaukee, has the contract for the steel superstructure. Estimated cost, $50,000. This bridge will be 405 ft. long and 135 ft. between abutments. It will be a single track bridge and composed of three truss spans.

—Frank Krug, county engineer, Cincinnati, has prepared plans for a steel viaduct to carry the canal over Mitchell avenue in that city, at an estimated cost of about $120,000.

—The contract for the Butler & Pittsburgh Railroad bridge over the Allegheny river at Denny station has been awarded, the price to be $153,000. The bridge will be about 3,000 ft. long, consisting of one channel span 500 ft., three spans 350 ft. and about 1,400 ft. trestle, 45 ft. high. The iron work is being manufactured by the Carnegie Steel Co., Limited. The bridge will contain 18,000 cu. yds. of stone masonry, and must be completed in the next six months.

—Bids are asked until September 15 for constructing six or more stone bridges for the Metropolitan water system, Boston, Mass.

—An election will be held in Marion county, Miss., on September 25, to determine as to issuing $20,000 of bonds for constructing a steel bridge. It is probable that the issue will carry.

—Bids are asked until September 25 for constructing a steel bridge to cross the Trinity slough near Mound City, Ill. Plans and specifications can be seen at Washington, D.C., and at City Engineer's office at Cairo and Mound City, Ill.

—The contract for the construction of a steel bridge at Florence, Ala., has been awarded to the Toledo (O.) Bridge Co.

—The county commissioners of Prince George county have rejected all the bids received Aug. 4 for building an iron bridge in Bladensburg and one in Queen Anne district, estimated to cost about $3,500 each.

—The Mississippi & La Fourche Railway Co. will have two iron bridges to construct, each one consisting only of a draw 220 ft. in length. Headquarters, Lauderdale, La

Buildings.

—Plans are being prepared for a $500,000 building for the Polytechnic Institute in Peoria, Ill., which is to be a branch of the University of Chicago. The money for the construction and equipment is to be given by Mrs. Lydia Bradley of Peoria.

—The Baltimore & Ohio Railroad Company is about to commence work on its proposed depot at Wheeling, W. Va. W. T. Manning, civil engineer of the company, has lately been in Wheeling with the plans, completing arrangements.

—Reports state that English capitalists have been investigating in Norfolk, Va., with a view of erecting iron works. It is stated they contemplated a plant to employ 300 men.

—Mead, Mason & Company has awarded a contract to Samuel Holt for 2,000,000 brick, to be used in the construction of the new railroad shops at Concord, N. H. It is stated that the foundations are completed and the brick laying will commence at once.

—A large machine tool works is contemplated by Lea & Carroll, to be located at Pittsburgh, Pa., to be equipped with machinery which will be of the most modern design.

—The Southern Express Company has completed a handsome office building at Memphis, Tenn. It is practically fireproof, and built largely of steel. It is eight stories in hight. The upper floors will be used for offices, and the first exclusively for the Southern Express Company proper.

—The car shops of the Cincinnati, Hamilton & Dayton R. Co. at Lima, O., were damaged by fire on Aug. 22, to the extent of $60,000.

—The Midvale Steel Company of Nicetown, Pa., has finished plans for a new foundry which is to be built in near future. The building is to be of brick and iron, 46x130 ft., one story high, and will cost about $35,000. The company will also erect a two-story pattern storehouse.

—The extensive railway shops of the Southern Railway Company at Salisbury, N. C., have been placed in operation. President Spencer started the machinery on the first day.

—Dr. J. R. Little and others have organized a company at Spartansburg, S. C., that will establish a plant for the manufacture of machine tools. It is stated that a site has already been purchased at a cost of $7,000.

—The Ohio Machine Company, Middleport, O., is enlarging its plant by the erection of a building 40x120 ft., to be used as an erecting shop. The concern manufactures the Pittsburgh feedwater heater.

Iron and Steel.

—A report has been published that the works of the American Steel Foundry Co., of St. Louis, were closed down and would remain so till after the presidential election. We are glad to be able to state that this report is altogether erroneous and that the company has sufficient orders ahead to keep the works running till November 1. These orders are for truck frames, bolsters, couplers of various patterns, locomotive frames, and special steel castings.

—A new company has been organized at Basic City, Va., capital, $50,000, for the manufacture of bridges, buildings and general structural iron work. It is known as the Virginia Iron & Investment Co.

—Work on the new blooming mill of the Pennsylvania Steel Co., at Steelton, Pa., is being pushed along while the mills are idle. The billet mill is idle. The bridge and construction and machine departments are very busy.

—The Premier Steel Co., Indianapolis, Ind., has recently received an order from the Louisville & Nashville Railway for 10,000 tons of steel rails.

—The chemical laboratory at Edgar Thompson Steel Works, at Braddock, was recently destroyed by fire, causing a loss of $75,000 which is fully covered by insurance. The fire originated in the basement of the building and was due to an explosion of chemicals. The laboratory will at once be rebuilt.

—The Shickle, Harrison & Howard Iron Co. is quite busy in its steel foundry department on orders for railroad castings, including motor gears, as well as on general machinery castings.

—The capital stock of the Glasgow Iron & Steel Works at Pottstown, Pa., has been increased from $500,000 to $800,000 instead of from $200,000 to $300,000 as stated in our issue of last week. The business of the company is reported as being most excellent.

Machinery and Tools.

—Mr. J. T. Wilson, general manager of the American Balance Slide Valve Co. of Jersey Shore, Pa., reports the usual good state of business with that company, among the recent orders being valves for 23 new locomotives for the Illinois Central Railway, for 20 locomotives on the Erie and 3 locomotives which are being built by the Richmond Locomotive Works for the Southern Railway. The introduction of air-motors for street railway traction has opened a new field for balanced valves, and this company's valves have been selected for attachment to several new air locomotives which are now being built. The application of the American balance principle to marine engines is also stated to be progressing satisfactorily.

—The Harrison Safety Boiler Works, Philadelphia, report a good business in Cochrane feed-water heaters and purifiers. Among orders at present in course of completion is one from the Ohio Steel Co., Youngstown, O., 2,000 horse-power heater; the McCormick Harvesting Machine Co., Chicago, 500 horse power: the Peoples' Electric Light & Power Co., Newark, N. J., 800 horse-power: the East Pittsburgh Water Co., Port Perry, Pa., 350 horse-power, and from U. S. Smith, Philadelphia, 300 horse-power.

—Joseph Goodman, of Pittsburgh, Pa., will apply for a chaster for the Goodman Engine & Machine Co., to be located at Pittsburgh for the manufacture of engines and general machinery.

—What is said to be the largest dynamo ever constructed is now being built at the Westinghouse Machine Co., at East Pittsburgh. It is for the Allegheny County Light Co., and when completed will weigh 90 tons. The field or base has been cast in two sections, each weighing 56,000 lbs. Its base is 17 ft. 6 in., so that the armature will be 16 ft. 5½ in. in diameter. The dynamo will be of 1,500 kilowatt power. The contract calls for four dynamos.

—The Morse Twist Drill & Machine Co., New Bedford, Mass., is making improvements by the addition of new machinery in all departments.

—The Buda Foundry & Manufacturing Co., Harvey, Ill., has secured control of Paulus track drill, and in the future will have charge of the manufacture and sale of that device.

—The Lloyd Booth Co., Youngstown, O., has recently shipped a shear table and several billet cars to the American Steel Co., at Indianapolis, Ind., this concern having succeeded the Premier Steel Works of that place. The first named concern is also working on a table for conveying hot billets from the continous heating furnaces to the roughing rolls of the Oliver Wire Co. of Bittsburgh and also one of the same for the Consolidated Steel & Wire Co., of Rankin, Pa. The charging machinery for charging the billets into the heating funaces for both concerns is also under erection by this firm.

Miscellaneous.

—Another report of excellent results of drop tests on malleable iron couplers has been received from Mr. B. H. Whiteley of the Whiteley Malleable Castings Co. These tests, like several others which have recently been recorded in these pages, were upon American couplers chosen at random from a lot ready for shipment, and were put under the drop by Mr. H. S. Bowen, representing Messrs. R. W. Hunt & Co. of Chicago. Fourteen couplers were tested out of a lot of 1,000, with the following results:

Bar No. 1.—3 blows at 10 ft., 7 blows at 15 ft., bar cracked in shank.
Bar No. 2.—3 blows at 10 ft., 7 blows at 15 ft., knuckle broken and bar broke through stem.
Bar No. 3.—3 blows at 10 ft., 8 blows at 15 ft., bar broke through stem under head, fracture good.
Bar No. 4.—3 blows at 10 ft., 8 blows at 15 ft., bar bent in stem, otherwise O. K.
Bar No. 5.—3 blows at 10 ft., 4 blows at 15 ft., bar broke in stem, fracture good.
Bar No. 6.—3 blows at 10 ft., 6 blows at 15 feet, knuckle broke, bar O. K.
Bar No. 7.—3 blows at 10 ft., 6 blows at 15 ft., bar broke through stem under head, fracture good. Knuckle in this bar broke at second blow at 15 ft. Test on bar continued with new knuckle.
Bar No. 8.—3 blows at 10 ft., 6 blows at 15 ft., back wall of bar split, fracture good.
Bar No. 9.—3 blows at 10 ft., 7 blows at 15 ft., bar bent in stem, otherwise bar O. K.
Bar No. 10.—3 blows at 10 ft., 7 blows at 15 ft., bar broken through stem under head, fracture good.
Bar No. 11.—2 blows at 10 ft., 7 blows at 15 ft., bar broken through stem under head; fracture shows dirt in iron.
Bar No. 12.—3 blows at 10 ft., 9 blows at 15 ft., knuckle broke, bar O. K.
Bar No. 13.—3 blows at 10 ft., 5 blows at 15 ft., knuckle broken, bar O. K.
Bar No. 14.—3 blows at 10 feet, 7 blows at 15 ft., bar broke through stem under head, fracture good.

—The shops of the Wabash Railway at Moberly, Mo., have been closed. Lack of business is ascribed as the reason for the company's action.

—The New York Dredging Co., World Building, New York, has just completed extensive terminal improvements for both the Norfolk & Carolina Railroad and the Southern Railway at Norfolk, Va., involving large bulkhead construction and filling in behind the same with spoil by its suction dredge "Boston," at the same time deepening the approaches to the wharves. The dredging plant has just been towed from Norfolk to Atlantic City, N. J., under contract to reclaim valuable areas of marsh land back of the city by pumping upon them sand from an island belonging to the owners of the marsh land.

—The Gillespie Car Coupler Co. of San Antonio, Texas, has been organized to introduce and manufacture a patent car coupler.

—The Standard Scale & Supply Co. has contracted to place an 80 ton track scale at the shops of the Erie Railroad at Kent, Ohio.

—Mr. Royal C. Vilas, sole dealer in the National electric headlights for locomotives, with offices at 1426-1427 Monadnock Block, Chicago, has found that many of the railroad managers, while recognizing the merit of the electric headlight, do not feel justified in making purchases at this time, giving as a reason that if Bryan is elected president they would probably not need any headlights at all. Mr. Vilas therefore makes the following proposition to all railroad companies: Orders for the electric headlights will be received by him upon the following conditions, viz: that if Bryan is elected president all equipments shipped up to the 31 day of November will be presented to the railroad companies with his compliments. If Bryan is not elected president, orders are to remain in full effect and equipments promptly paid for.